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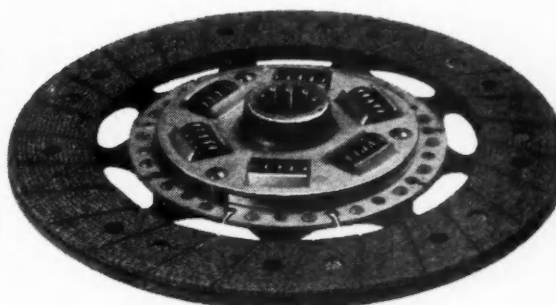
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PLASTICS

August 15, 1939

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Automotive Industries

Jacklin Tests Traction; Nebraska Tests Tractors

***Two news reports on matters of engineering interest;
additional news of the industry begins on page 175***

IN A study of the safe-performance possibilities of road vehicles, made by H. M. Jacklin, M.E., of West Lafayette, Ind., for the Four-Wheel Drive Auto Company of Clintonville, Wis., comparisons are made between the characteristics of rear-wheel-driven, front-wheel-driven, and four-wheel-driven vehicles. The behavior of the vehicles on the road depends, of course, on a good many factors, and in making comparisons between the three types, definite values are assigned to these factors. For instance, it is shown that if the coefficient of friction between wheel and road is 0.8, the center of gravity is located midway between front and rear-wheel axes and at a height equal to 30 per cent of the wheelbase; if the air-resistance coefficient is 0.0025, the frontal area 80 sq. ft., and the rolling resistance 25 lb. per 1000, to give equal protection against slipping of the drivers, the rear-wheel-driven truck must weigh 1.545 times and the front-driven truck 2.52 times as much as the four-wheel-driven truck. Assuming all three trucks to have a g.v.w. of 20,000 lb., at 20 m.p.h. the driving wheels will be on the point of slipping if the coefficient of friction between tire and road is 0.03301 in the case of front drive, 0.03298 in the case of rear drive, and only when it is as low as 0.0165 in the case of four-wheel drive.

From his analysis of the traction condition with the three types of vehicle the author concludes that the four-wheel drive principle has much to commend it from the point of view of operation on straight, level roads. There is less danger of slipping the driving wheels, and there is therefore also less danger of skidding. This permits of installing more powerful engines in four-wheel drive vehicles of a given g.v.w., thereby increasing their acceleration and hill-climbing ability, and with this increased power better time can be made with greater safety.

Assuming that the hill-climbing ability of the vehicle is limited by the adherence between tires and road surface, it is shown that for equal engine power the four-wheel drive truck will have an advantage of 17.5

per cent over the rear-wheel-drive truck if the load distribution in the latter is 60 per cent on rear and 40 per cent on front wheels; and an advantage of 42 per cent if the load is equally divided between front and rear wheels. On grades also, since for a given tractive effort the driving wheels will be further from the slipping point in the four-wheel drive, there is less danger of skidding with the latter. This greater immunity from slipping and skidding warrants the use of engines of 25 per cent more output, which in turn makes possible higher speeds on hills.

The author also finds that the four-wheel drive vehicle is safer on curves. He says the decreased demand for friction to provide the driving force at the driving wheels enables the four-wheel-drive vehicle to negotiate sharper curves at the same speed or the same curves at higher speed than the other types of drive. The unused component of the available friction force is again available to enable the vehicle to help maintain its position or path on crowned road surfaces, as well as to resist the effects of surface irregularities and obstructions.

"Further, it appears practical to install engines of greater capacity in four-wheel-drive commercial vehicles, to the end that the vehicle can approach more closely the performance characteristics of passenger cars, so that greater mobility and safety should result."

Reports on Three New Tractors

AMONG farm tractors recently tested by the University of Nebraska are an Allis-Chalmers RC (distillate), an M-M Twin City GT (gasoline), and a Massey-Harris "101" R Junior. Tractor test reports Nos. 316, 317 and 318 cover these tests.

The Allis-Chalmers is a tractor of the tricycle type, equipped with a four-cylinder $3\frac{3}{8}$ by $3\frac{1}{2}$ -in. engine rated at 1500 r.p.m. Its transmission gives four for-

ward speeds and one reverse, the advertised forward speeds being 2, 2.8, 3.75 and 7.5 m.p.h., and the reverse, 1.75 m.p.h. The rear tread is adjustable between the limits of 65 and 76 in., while the front tread is 13 $\frac{5}{8}$ in. at the top and 9 $\frac{3}{8}$ in. at the bottom. Pneumatic tires are fitted, the rear tires, which are 10 by 28-in., four-ply, being inflated to 12 lb. per sq. in.; the front tires, 4.75 by 15 in., four-ply, to 22 lb. per sq. in. Traction is increased by adding to each rear wheel 425 lb. of cast iron and 199 lb. of calcium-chloride solution, and each front tire is weighted by 25 lb. of calcium chloride solution.

The engine developed a maximum output of 18.21 hp. with a specific fuel consumption of 0.574 lb. per hp.-hr., the fuel used being distillate of 39 octane number. In the drawbar tests the following drawbar pulls were developed in the different forward gears: 2840, 2067, 1509 and 716 lb. The permissible ratings for this tractor (75 per cent of the calculated maximum drawbar hp. and 85 per cent of the calculated maximum belt hp.) are 12.09 drawbar hp. and 16.16 belt hp.

The Twin City GT tractor is of the standard four-wheel type and is equipped with a four-cylinder 4 $\frac{5}{8}$ by 6-in. engine rated at 1075 r.p.m. This tractor has a four-speed and reverse transmission, the advertised forward speeds being 2.7, 3.8, 5.8, and 9.6 m.p.h., and the reverse speed, 2.8 m.p.h. The front tread is 51 in., the rear tread, 56 $\frac{1}{2}$ in. Front tires are 7.50 by 18, four-ply; rear tires, 13.50 by 32, six-ply. The former are inflated to 28, the latter to 16 lb. per sq. in. Traction is increased by the addition of 850 lb. of cast iron and 420 lb. of water to each rear wheel, while front wheels have 80 lb. of cast iron added.

The engine developed a maximum output of 55.08 hp. with a specific consumption of 0.526 lb. per hp.-hr. of gasoline of 70 octane number. In the drawbar tests at maximum load the drawbar pulls in the various gears were 5068, 4866, 3186, and 1793 lb. The permissible ratings (75 per cent of the calculated maximum drawbar hp. and 85 per cent of the calculated maximum belt hp.) are 36.27 drawbar hp. and 48.93 belt hp.

The Massey Harris "101" R Junior is a tricycle-type tractor

with a four-cylinder L-head engine of 3-in. bore by 4 $\frac{3}{8}$ -in. stroke, which is rated at 1500 r.p.m. for drawbar hp. and at 1500-1800 r.p.m. for belt hp. This tractor also has four forward speeds, of 2.6, 3.6, 4.9 and 17.4 (1800 r.p.m.) m.p.h. and a reverse speed of 2.3 m.p.h. The rear tread is adjustable between the limits of 52 and 90 in., while the front tread is 12 in. at the top and 8 in. at the bottom. Rear tires are 10 by 36 in., four-ply, inflated to 16 lb. per sq. in., while front tires are 5 by 15 in., four-ply, inflated to 28 lb. per sq. in. Rear wheels have 268 lb. of cast iron and 225 lb. of water added each.

The engine developed a maximum of 26.27 hp. with a specific fuel consumption of 0.561 lb. per hp.-hr. of gasoline of 70 octane number. The maximum drawbar pulls in first, second, and third speeds were 3079, 2362, and 1761 lb. The permissible ratings (75 per cent of the maximum calculated drawbar hp. and 85 per cent of the calculated maximum belt hp.) are 16.35 drawbar hp. and 23.74 belt hp.

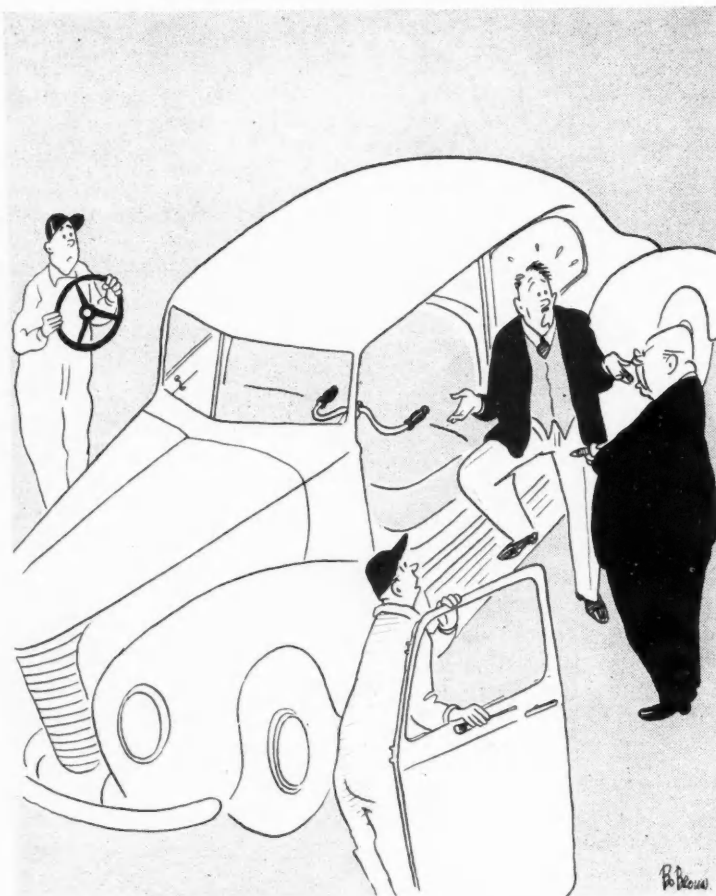
Electric Trucks Gain Favor

A NEW wave of interest in electric commercial vehicles has appeared in European countries that are compelled to import their petroleum products. The electric truck, of course, is best adapted for short hauls, where it is not necessary to cover any great

mileage per day. In England it is estimated that of the 492,000 motor trucks in the country, 300,000 do not run more than 30 miles per day, which mileage can be readily covered on a single battery charge.

One thing that has hampered the introduction of electric vehicles is the high cost of batteries. A plan that relieves the truck buyer of the necessity of buying a battery, and which is said to have been in operation in Germany for some years, has now been introduced in Great Britain. A firm known as Battery Traction, Ltd., has been organized which has entered into contracts with electric utilities in London, Liverpool, Manchester and Glasgow for the establishment of stations at which operators may exchange batteries.

The Brass-Hat Rack



—Just because you're mad at the steering wheel vendors doesn't mean the public won't want wheels

BUSINESS IN BRIEF

*Our own view of automotive production and sales;
authoritative interpretation of general conditions*

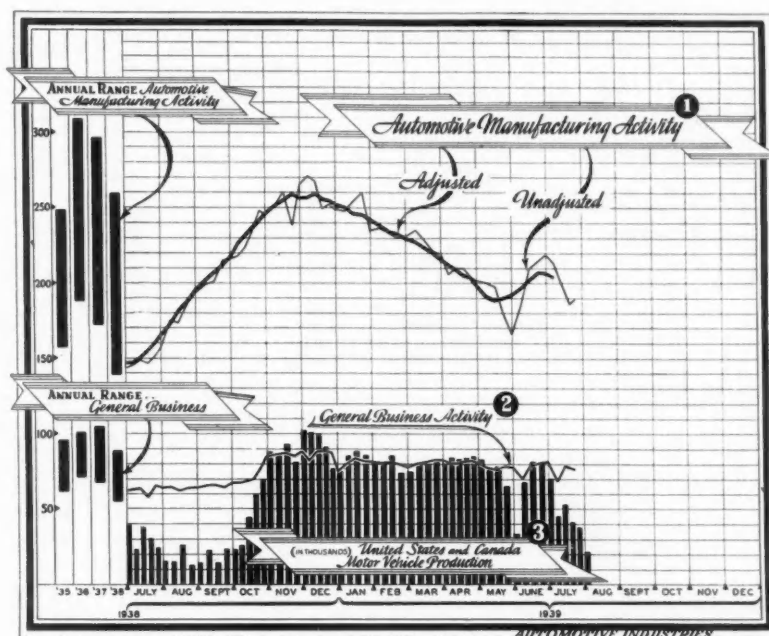
PRODUCTION of cars and trucks for the first two weeks in August reached the expected low point of the year with a majority of passenger car manufacturers busily engaged in changeovers in preparation for their 1940 models. Output during the first week in the month was estimated³ at approximately 24,000 units with the second week expected to be slightly lower so that the first two weeks were expected to account for approximately 45,000 cars and trucks.

A considerable upswing in production is anticipated for the second half of August with a number of important producers expecting to get under way on final assemblies. Settlement of the UAW-CIO tool and die makers' strike, which delayed retooling for 1940 models in General Motors plants, indicated that Buick, Oldsmobile and Pontiac would be underway before the end of August while most Chrysler divisions also were expected to be in active production before the end of the month.

Preliminary opinions of industry leaders place 1940 model production totals at the same or slightly higher levels than those reached on 1939 models. From September 1938 through August 1939, which roughly approximates the 1939 model season, total production has exceeded 3,400,000 cars and trucks. The official estimate of July production issued by the Automobile Manufacturers Association sets output at 218,000 units for the past month.

AUTOMOTIVE MANUFACTURING ACTIVITY, as reflected by the movement of the unadjusted index¹

¹ 1923 average = 100; ² Prepared by Administrative and Research Corp., New York. 1926 = 100; ³ Estimated by J. A. Laansma, Detroit News Editor, AUTOMOTIVE INDUSTRIES. ⁴ Summarized for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co. of New York.



**Weekly indexes of automotive general business
charted**

Production at Low Point of the Year

charted on this page, slid to a low point of 186 for the week ended July 22. However, the unadjusted curve regained three points and stood at 189 for the week ended July 29. The adjusted curve¹ for the week ended July 1 remained at the preceding week's mark of 207, and fell off three points to 204 for the week ended July 8.

GENERAL BUSINESS ACTIVITY⁴ continues to improve. The index of the *Journal of Commerce* for the week ended July 29 rose to 89.1, a new 1939 peak, as against

87.1 for the preceding week and 86.1 a week earlier.

Electric power production during the week ended July 29 rose to the year's peak so far, two per cent above output in the week before and 11.8 per cent more than in the corresponding period last year.

The movement of railway freight increased slightly in the same period. Loadings totaled 659,764 cars, 3423 cars more than in the preceding week and comparing with 588,697 cars a year ago.

Crude oil production in the week ended July 29 declined to an average of 3,539,100 barrels daily, as against 3,583,750 barrels for the preceding week and 3,316,400 barrels a year ago. Daily requirements during June, as computed by the Bureau of Mines, were 3,513,200 barrels.

Professor Fisher's index of wholesale commodity prices for the week ended Aug. 5 stood unchanged from the preceding week at 78.6 per cent of the 1926 average, which was one fractional point above the year's low mark so far recorded two weeks earlier.

The General Motors-Cornell World Price Index of 40 basic commodities for the week ended July 29 was 60.2, compared with the previous week's figure of 60.5 and the figure of 60.8 for two weeks earlier.

BUSINESS ACTIVITY

Automotive MATERIALS 30

The

By MAURICE BONZEL*

A SPRING is an accumulator of energy whose functioning is based on one of the fundamental properties of solids, that of elasticity. The valve spring of an internal-combustion engine is a typical example of the problem of charging and discharging such an accumulator at a very rapid rate, by "saturating" the material of which it is composed (with energy) to the limit compatible with safe operation. How severely the material of valve springs is worked in practice may be appreciated when it is stated that these springs at normal engine speeds absorb and give out energy at the rate of several horsepower per kilogram of metal.

The energy which can be stored in a spring per unit of mass may be increased by either modifying the form of the spring or by changing the treatment to which the material is subjected. No great improvement can be hoped for from a change in design, for it is easy to show that as soon as the type of spring has been selected and the maximum stress fixed, the energy stored depends only on the volume of material employed. Thus for

* Paper read before the (French) Society of Automobile Engineers. Slightly abridged.

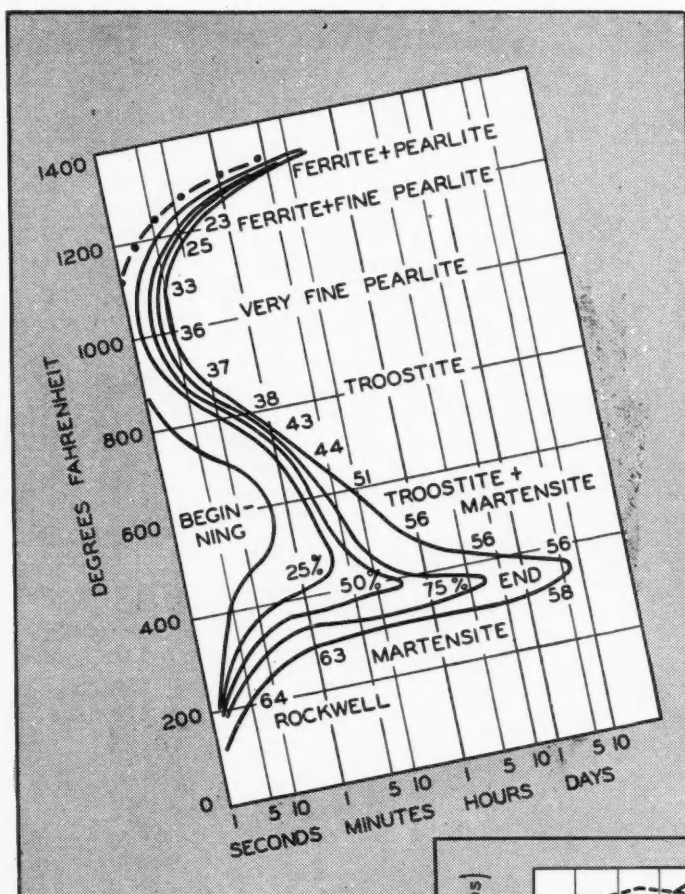
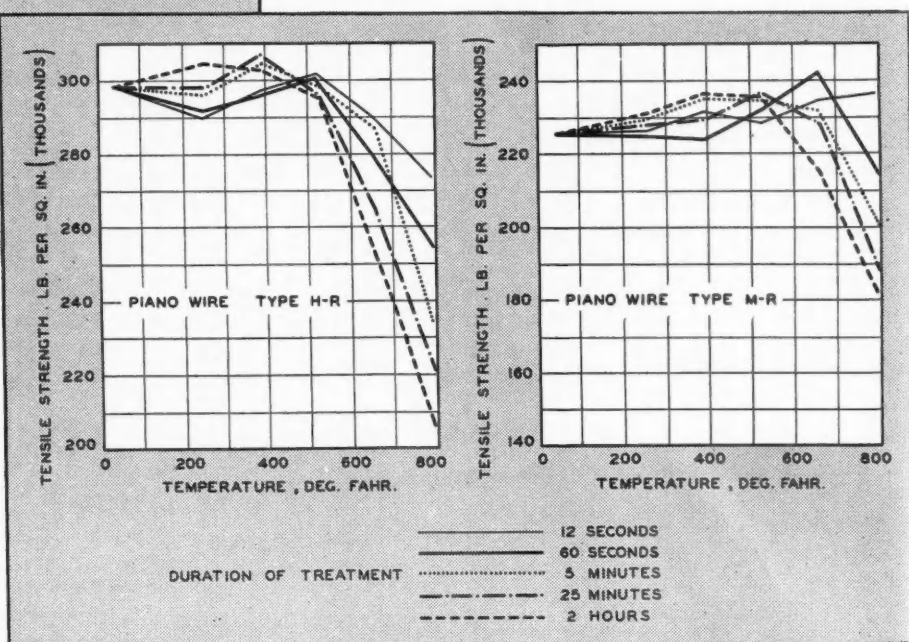


Fig. 1—Duration of transformation on cooling of a hypoeutectic hard steel as a function of the temperature of the quenching bath (from Davenport and Bain).

Fig. 2—Effect of heating for various periods and at various temperatures on the tensile strengths of two types of piano wire for valve springs.



Valve Spring

as a metallurgical problem

cylindrical, helical springs of round wire, subjected either to tension or compression, the energy per unit of volume is equal to

$$\frac{S_1^2 - S_2^2}{4G}$$

where S_1 and S_2 are the maximum and minimum shearing stresses and G is the modulus of elasticity in shear of the material. For a cylindrical helical spring working in torsion the stored energy per unit of mass is

$$\frac{S_1^2 - S_2^2}{8E}$$

where E is the modulus of elasticity. In either case it does not make any difference—at least as far as a first approximation is concerned—whether a long thin or a short thick wire is used, provided the material and weight are the same.

On the other hand, a reduction in the modulus of elasticity, and especially an increase in the stress, which enters into the expression with the second power, permits of lightening the spring. From this point of view the valve spring presents an interesting metallurgical problem.

In practice the problem is complicated by very important parasitic phenomena, those of spring surge. The natural frequency of vibration of a valve spring may be expressed in the form

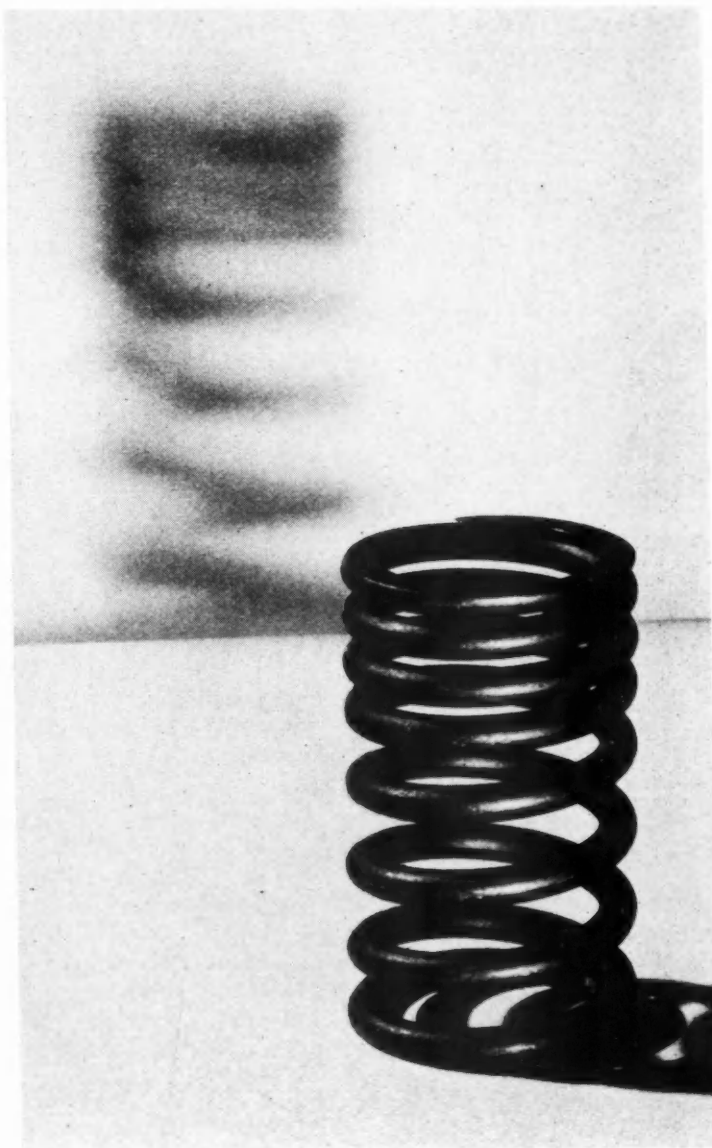
$$f = K \frac{ds}{dl}$$

dl being an infinitesimal change in length of the spring and ds the corresponding change in stress. This equation shows that it is impossible to increase the natural frequency of the spring by a change in its form if the valve life is fixed and if the maximum stress in the spring material has been set. However, any increase in the stressing of the spring material results in an increase in the frequency, which relationship lends additional interest to the search for an improvement in the permissible stress range $S_1 - S_2$. I will show to what extent recent research work has permitted of increasing this stress range.

Three types of material are being used in the manufacture of valve springs, viz.: (1) Piano wire, a non-isotropic product obtained by cold-working; (2) hard-

ened and tempered carbon steel, and (3) certain alloy steels.

If a mass of steel which has previously been brought to the γ state of solid solution is suddenly cooled, by means of a metallic bath, for instance, the structure obtained varies with the temperature and the time. Fig. 1 represents the time required for the change



from the γ to the α state, as a function of the temperature of the hardening bath, for a carbon steel close to the eutectoid (according to Davenport and Bain). It will be seen that the time passes through a very pronounced maximum for a temperature close to 350 deg. Fahr. If the solid solution has been brought to this temperature by a very drastic cooling effect, the austenite will be very stable. This maximum stability at relatively low temperatures is a phenomenon which is taken advantage of in the treatment of certain tool steels.

During the second stage of the cooling period, from the temperature of maximum stability of the austenite down to atmospheric, martensite is produced in the same manner as if the metal had been quenched directly in a cold bath, but with a certain number of advan-

tages which need not be discussed here in detail.

Fig. 1 shows two minima for the duration of the transformation, one of these corresponding to the martensitic transformation, that is to say, to normal hardening; the other to a very fine lamellar pearlitic structure, the latter being the starting point for the manufacture of piano wires. This structure, which corresponds to an increase in hardness with respect to the pearlitic state of a normal anneal, is obtained by passing the wire continuously through a heating furnace and then through a hardening bath. A metal which has been treated in this way will withstand great plastic deformation, owing to the fine pearlite laminae. This property is made use of by drawing the wire down to the desired diameter.

Therefore, in the final analysis, the mechanical and structural characteristics of piano wire are the result of a more-or-less judicious combination of the two hardening methods—special heat treatment and wire drawing or cold working.

The composition of the steel from which piano wire is made is close to the eutectoid (0.85 per cent carbon), the object being to secure a high structural homogeneity. However, as it is desirable to avoid the possibility of hypereutectic cementite depositions, the carbon content is generally kept below 0.85 per cent.

It is possible to list more than thirty factors on which the final characteristics of piano wire depend. The principal factors are the carbon and manganese contents, the hardening temperatures (furnace and molten-lead bath), the time the wire remains in the quenching bath, the ratio between the diameter of the wire when heat treated and that to which it is finally drawn, the presence of inclusions, and the final surface condition.

A systematic study of all of these factors is necessarily long and tedious. Therefore, when an improvement in quality is aimed at, it is advisable to choose with care a criterion of this quality which can be expressed in figures. The best criterion is undoubtedly the resistance to almost indefinitely continued repetitive stress fluctuations.

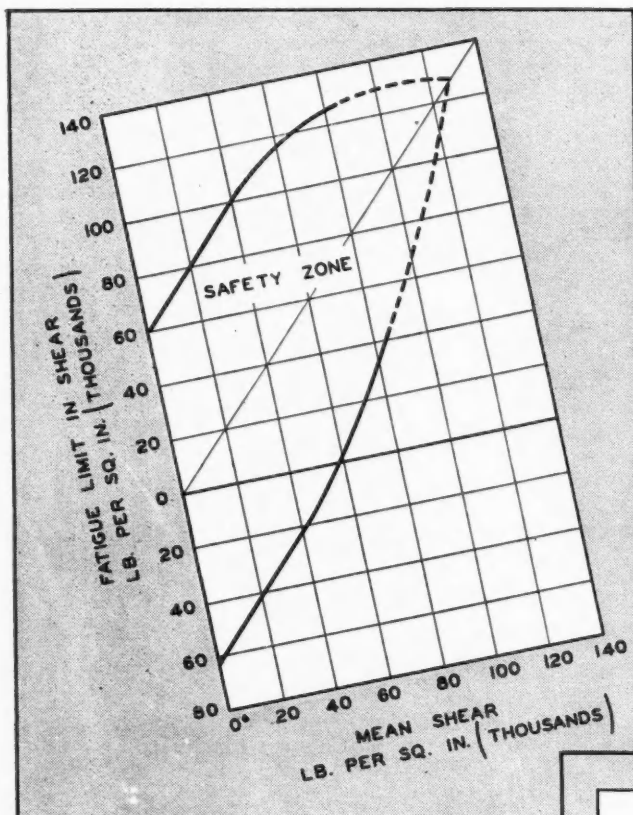
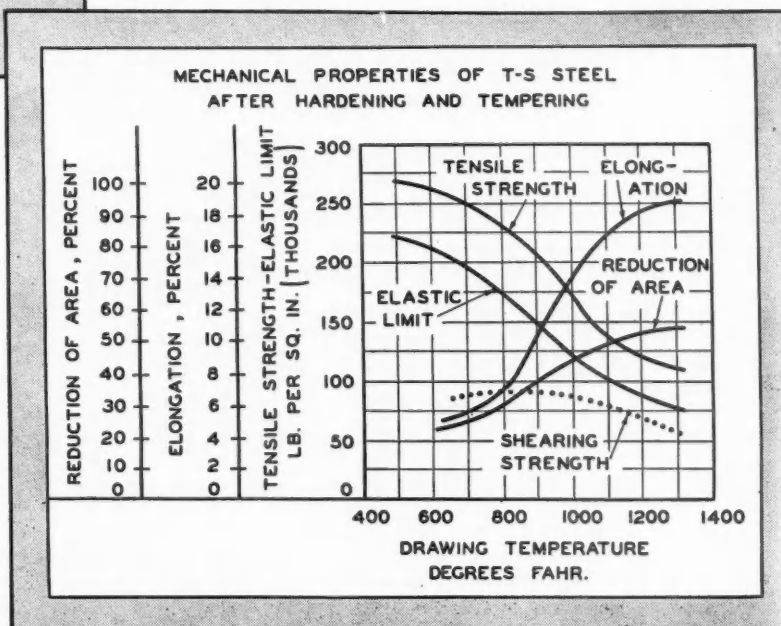


Fig. 3—Fatigue limit in shear of a very good grade of piano wire for valve springs, after heating for 10 minutes at 525 deg. Fahr.

Fig. 4—Effect of drawing to different temperatures on the principal mechanical properties of an Mn-Si-Cr steel, hardened and tempered.



As is well known, the determination of resistance to repetitive stresses (fatigue strength) has grown in importance in materials-testing technique in recent years. It is customary to subject successive test specimens of the same lot to repetitive stresses until they fail, each successive specimen being subjected to a higher stress. As the stress increases, the life of the specimen decreases. If the results of the entire series of tests are plotted by making the maximum fiber stress the ordinate and the number of stress applications withstood the abscissa (on a logarithmic chart) a curve is obtained which appears to permit of an asymptote, the value of the latter giving the stress which the specimen will withstand indefinitely without failure. This stress, in the most highly stressed fiber, in lb. per sq. in., is the fatigue limit of the metal for the particular method of stressing employed in the test.

A special machine for endurance tests of wires intended for valve springs has been developed by the Etablissements Bohin. This machine takes straight specimens without special machining of the ends, hence it permits of studying the important effects of surface condition. It is equipped to permit of making tests at all temperatures to which valve springs are normally subjected, and offers the possibility of varying the stress between the two limits which are chosen arbitrarily, in such a way that the stress applications may be repeated or alternated at will, symmetrically or unsymmetrically. This machine comprises an oscillating clutch which is driven electrically, and a sliding clutch which receives periodic torsional impulses that are transmitted by the specimen. This second clutch in turn may impose constant supplementary torsional or bending stresses, and is equipped to automatically open the circuit of the electric motor, and the heating circuit for the specimen, at the moment the latter breaks. A counter registers the number of cycles performed up to the time of the break.

In the determination of the fatigue limit of wire for valve springs, it is absolutely necessary to take account of an operation which forms a part of the manufacturing technique of the spring itself but whose repercussions on the characteristics of the metal are considerable; that is, the heat treatment at a temperature of 575 deg. Fahr., which passes under the name of "finishing operation" or "blueing."

This treatment, applied to a steel of high carbon content and strongly cold-worked, constitutes a veritable structural hardening, accompanied by increases in the elastic limit and the ultimate strength, by reduction of the elongation, and by increase of the brittleness. The torsion test, especially, brings out the susceptibility of the metal to this treatment, and the number of turns before failure may be reduced from 20 to 90 per cent by simply heating for 10 minutes to 575 deg. Fahr., according to the conditions of production. Also, the mechanical characteristics of the steel at high temperatures, which are of such great importance in the case of springs for exhaust valves, are strongly influenced by this treatment, which raises the flow limit materially.

If the fatigue limit of the piano wire is measured in the natural state, without heating, it may lead to

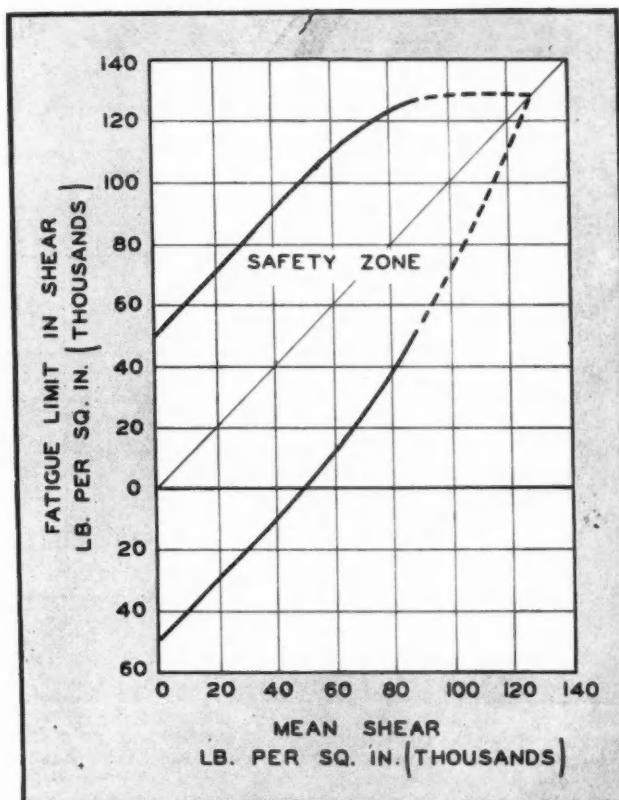


Fig. 5—Fatigue limit in shear of an Mn-Si-Cr steel hardened and tempered under the most favorable conditions.

quite erroneous conclusions as to its adaptability for valve springs. It may be found, for instance, that the resistance to repetitive stress applications is less for the finished wire than for the wire before it is work-hardened by drawing. A simple reheating to 575 deg. Fahr. completely reverses these results. Fig. 2 (one of several similar charts given by the author) shows the influence of heating to various temperatures and for various periods, on the tensile strength of two types of piano wire, one of comparatively low strength, which has been reduced in diameter only slightly by drawing; the other of greater strength, due to more severe drawing. The compositions of the steel and the other conditions of manufacture were as nearly alike as possible.

The influence of reheating on the mechanical properties is the more pronounced the more the wire is reduced by drawing, and in the same measure as the mechanical work due to drawing increases, the temperature which corresponds to the maximum effect diminishes. Taking account of the important modifications produced by the final heat treatment, experience shows that the best piano wire for valve springs is not that which has the highest tensile strength but that which combines great plastic-deformation possibilities with a good elastic limit and which, besides, possesses a good surface free from flaws.

Maintenance of a high degree of plasticity after heat treatment and systematic elimination of even minor surface flaws are the two conditions which permit of attaining the high endurance characteristics shown by Fig. 3.

In the manufacture of valve springs, considerable

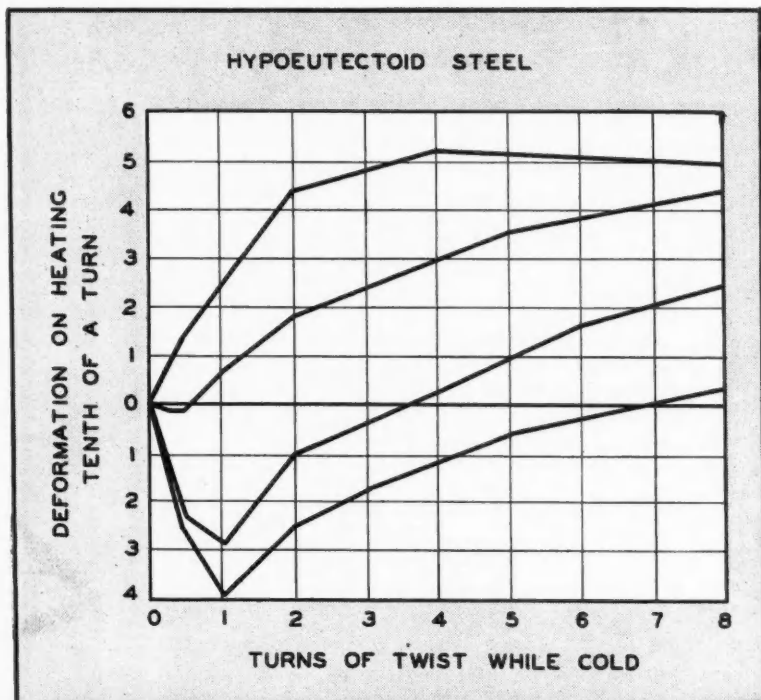


Fig. 6—Variation of the deformation on heating, as a function of the initial cold work, of specimens of the same steel having previously undergone different heat treatments. For each type of heat treatment there is a degree of cold work which corresponds to zero deformation after heating.

use is made—especially outside of France—of carbon-steel wires that are hardened and tempered. These wires differ from piano wire in not having been work-hardened and in being very nearly isotropic. It is, of course, necessary to keep the metal sufficiently malleable to permit of coiling the wire into springs without risk of starting even the most minute cracks. For this reason the carbon content must be distinctly on the hypoeutectic side, and tempering must be effected at a relatively high temperature. A steel with a carbon content of about 0.60 per cent and a manganese content of 0.80 per cent is commonly used, the mechanical properties of this steel being held within the following limits:

Tensile strength—205,000-230,000 lb. per sq. in.

Elastic limit—155,000-170,000 lb. per sq. in.

Elongation—8-10 per cent

Contraction of area—45-55 per cent

These characteristics are not very different from those of the piano wire used for valve springs, and the question immediately arises as to whether—the mechanical properties being substantially equal—the piano wire should be preferred, or whether the heat-treated wire has a higher fatigue limit.

Assuming the surface conditions to be alike, there is no appreciable advantage in favor of one or the other; but the condition of the surface has such a profound effect on the endurance limit that the care taken in the manufacturing process is of much greater importance than the difference between these two hardening treatments.

This opinion, based on a larger number of personal observations, is in full accord with the works of different authors, and especially with the report of the

Springs Research Committee which was published in London in 1931, which comprises several contributions on this subject.

The work of Messrs. Swan, Sutton and Douglas, on the one hand, and that of Messrs. Lea, Batey and Hankins on the other, has shown that the fatigue limit may be considerably raised, and sometimes even doubled, by the elimination of surface defects such as scratches, pin holes and fissures, and especially by machining away the layer that has been decarburized in the course of the various heat treatments to which the metal has been subjected.

The fatigue limit for piano wire given in Fig. 3 may be regarded as a maximum which can be obtained only by very careful finishing of the surface after drawing, and this maximum cannot be exceeded by a wire of carbon steel that has been hardened and tempered, no matter what the heat treatment may be.

Owing to the fact that the metallurgy of alloys, and especially that of alloy steels, has made such progress during the past few years, the use of carbon steel for such delicate applications as valve springs may seem behind the times. Attempts to improve piano-wire steel by the addition of alloying elements have not always resulted

satisfactorily; on the other hand, several types of alloy steels are successfully being used in the tempered state, notably a chrome-vanadium steel containing about 0.50 per cent carbon, 1 to 5 per cent chromium and 0.25 per cent vanadium; a chromium-nickel-molybdenum steel containing about 0.35 per cent carbon, 2.5 per cent nickel, 0.6 per cent chromium and 0.4 per cent molybdenum, and more particularly steels rich in silicon, with the possible addition of chromium and molybdenum.

The addition of silicon to carbon steel has the effect of reducing the region of the solid solution of γ iron on the equilibrium diagram. The lower transformation point A_1 is raised, point A_2 is lowered, and the carbon content of the eutectoid diminishes. For instance, for a steel containing 2 per cent silicon, the eutectoid corresponds to approximately 0.6 per cent carbon and the points of the beginning and end of transformation are practically identical.

A ferro-silicon not carburized, with a silicon content of 2 per cent, has no transformation point (critical point) at all. It is known that chromium has a similar effect, which, however, is not so pronounced, since the γ region of the ferro-chromes, not carburized, ends only at a chromium content of 13 per cent. On the contrary, manganese tends to enlarge the austenitic field and in a way compensates for the effects of chromium and silicon. As all of these alloying elements individually have a favorable influence on the mechanical properties of steels, it is not unreasonable to expect that their simultaneous action would result in improving the quality appreciably.

Numerous investigations have been made along this line, with the object of determining the most favor-

able compositions. As usual, there is always a certain latitude with regard to the final choice, depending on the greater or lesser importance attached to any particular factor in the final compromise.

Thus, for instance, manganese improves the penetration of the quench but increases the tendency to crack; it diminishes the tendency to decarburize during the heat treatments, but increases the sensibility to over-heating. Silicon has the inverse effect.

Taking account of these different effects, the author's firm selected a chromium-manganese-silicon steel which seemed to combine the maximum advantages, for the manufacture of valve springs. This steel has the following composition:

Carbon—0.56-0.62 per cent
Manganese—0.55-0.75 per cent
Silicon—1.50-1.90 per cent
Chromium—0.65-0.85 per cent
Sulfur—less than 0.030 per cent
Phosphorus—less than 0.030 per cent

This material was studied systematically with the object of determining the heat treatment resulting in the best endurance qualities. This study showed that the optimum quenching temperature is in good accord with the dilatometric diagram, as would be expected. It was found, moreover, that the fatigue limit passes through a maximum for a drawing temperature of 840-875 deg. Fahr. Such a drawing operation restores the elongation to a notable extent (approximately 10 per cent) without appreciably diminishing the tensile strength and the elastic limit (Fig. 4).

These results are in agreement with those obtained by M. Piquet on a silico-manganese steel without chromium, as well as with those of M. Cazaud on a chromium-molybdenum-silicon steel.

It should be understood that even in this case the endurance limit is the higher the more nearly perfect the surface layer, for which reason it is advisable to

use for valve springs only rods which have been ground and carefully polished.

It is, moreover, absolutely essential to take the greatest precaution to prevent all decarburization during the final heat treatment, for even though it be only a few thousandths of an inch deep, it suffices to reduce the endurance limit by from 15 to 20 per cent. All necessary precautions being taken, the fatigue limit on which it is permissible to count is given by Fig. 5.

Warping During the Quench

While this steel was under development, it was noted that it warped strongly and irregularly during the quench. It was impossible to determine the cause of these deformations during the early investigations, and a systematic study was therefore entered upon. This study was made with the aid of an apparatus which registered every phase of the deformation while the springs were being heated. It brought into relief the preponderant influence of the physico-chemical structure of the metal before coiling. The final deformation is the result of phenomena having two quite distinct causes, viz., the differential relaxation between the surface layer and the core of the wire, and the recrystallization preceding the allotropic transformation of metal which has been cold-worked.

By suitably combining the operations of wire-drawing and annealing of the wires, it is possible to vary the relative influence of the two causes of deformation of the wire within wide limits, so as to effect a practically complete compensation of the two phenomena (Fig. 6). It is then possible to obtain springs of the correct form and to maintain the very narrow tolerances on dimensions and "rate."

This example shows that although the endurance limit is the principal criterion of quality of a valve-spring steel, one must not neglect other factors which may play an important role in passing from laboratory operations to industrial production.



NEW DEVELOPMENTS

Addition Agent for Engine Oils

An addition agent for engine lubricants known as Elektrion R is being produced by Société des Huiles De Cavel & Roegiers, Ghent, Belgium. It is produced from mineral oils by treatment with electric glow discharges, which appear to produce chemical and physical changes in the oil. Elektrion R oil has an API gravity of 21.5 at 60 deg. Fahr., a specific gravity of 0.925, a viscosity of 1000 Saybolt seconds Universal at

210 deg. Fahr., an open-dish flashpoint of 440 deg. Fahr., an acid number 1, a saponification number 90, a Conradson carbon content of 0.4 per cent, and an ash content nil. It is soluble in petroleum ether and mineral lubricating oils.

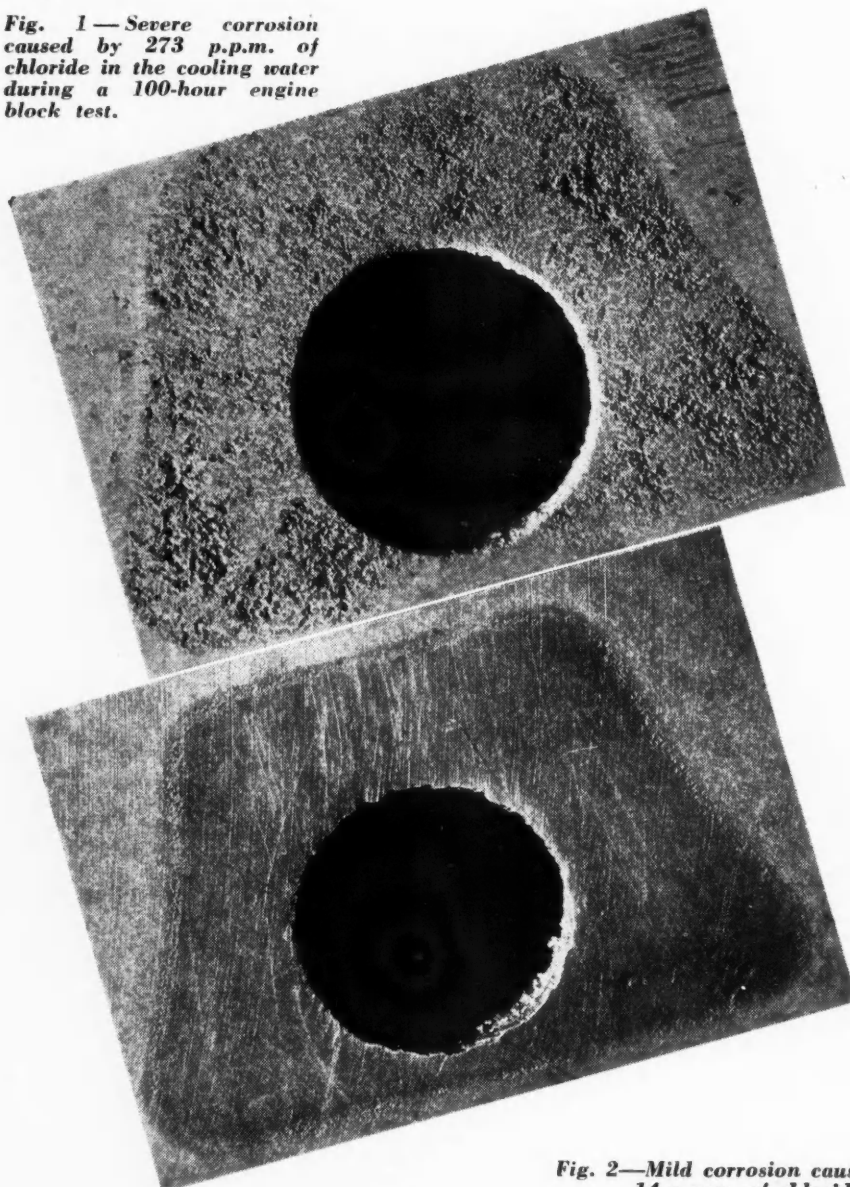
Elektrion R oil is added to lubricating oils in proportions of 5 to 15 per cent. One of the effects of the addition is to increase the viscosity of the oil. Of perhaps greater importance is the fact that it improves the oil with respect to its viscosity index. The graph herewith shows the improvement of the viscosity index

(Turn to page 190, please)

Corrosion Resistance

R By L. W. KEMPF and M. W. DAUGHERTY*
 ECENT investigations conducted under the auspices of the Aluminum Association showed that while the great majority of aluminum cylinder heads have developed practically no corrosion after many years of service and a great many thousands of miles of travel, a few have failed as a result of harmful salts in the cooling water. The investigation has indicated that the principal cause of severe corrosion is a high concentration of chlorides in the cooling water, and that corrosion can be practically eliminated by any one of three methods, as follows:

Fig. 1—Severe corrosion caused by 273 p.p.m. of chloride in the cooling water during a 100-hour engine block test.



1. Introduction of a soluble-oil inhibitor into the coolant;
2. Use of a properly-designed cylinder-head gasket, and,
3. Use of coolants of low chloride concentration.

Examination of a number of corroded heads from the field indicated only superficial corrosion on areas more than an inch or so, along the water path, from the gasket, even where the areas near the gasket were severely corroded. Severe corrosion appears as deep pitting of the machined surface around each of the water-inlet holes. Such areas are subject to electrolytic corrosion, since they are adjacent to the gasket-contact line, and are also subject to severe erosion, since the holes in the head are smaller than the corresponding holes in the block and gasket. Examination led to the conclusion that the corrosion was largely electrolytic in nature, with erosion as a contributing factor.

The following factors appeared to include those of principal significance in the corrosion process:

1. Composition of cooling water.
 - a. Source of supply.
 - b. Anti-freeze agents used.
 - c. Corrosion inhibitors used.
 - d. Leakage of exhaust gases into coolant.
 - e. Original cleanliness of cooling system.
2. Mechanical features.
 - a. Design of gasket. ●
 - b. Design of head.
 - c. Possibility of inserts at corrosion areas.
3. Gasket material.
4. Cylinder-head material.
 - a. Composition.
 - b. Heat treatment.
 - c. Soundness.

Trial corrosion tests on an engine block demonstrated that by using water of high chloride concentration in the cooling system, satisfactorily indicative tests could be made with runs of 100 hours' duration at 2400

* Both of the co-authors of this article are of the Cleveland Section, Aluminum Research Laboratories, Aluminum Co. of America.

Fig. 2—Mild corrosion caused by straight Cleveland tap water containing 14 p.p.m. of chloride during a 100-hour engine block test.

of Aluminum Cylinder Heads

r.p.m. and light load. A series of about 30 block tests using approximately these conditions have been completed with a Ford V8-85 engine. Steel-asbestos gaskets were used where not otherwise noted.

Chlorides Cause of Corrosion

The engine block-test results, as well as observations from the field, indicate that high chloride in the cooling water is the major factor in the corrosion of aluminum cylinder heads. In seven of the engine block-tests, Cleveland tap water, the chloride concentration of which had been increased to 273 parts per million by the addition of sodium chloride to simulate a typical high-chloride water supply, invariably caused serious corrosion. The extent is illustrated by Fig. 1, which is a magnified view of the corrosion area around the lower central inlet hole of one of the test heads. One-half this concentration of chlorides, 137 p.p.m., proved almost equally corrosive.

Straight Cleveland tap water, containing only 14 p.p.m. of chloride, caused far less corrosion than the high-chloride water, as is illustrated in Fig. 2.

Cleveland tap water with the following additions of sulfates or of sulfuric acid was found no more corrosive than straight Cleveland tap water.

1. Sulfates (332 p.p.m. calcium sulfate plus 175 p.p.m. sodium sulfate).
2. Sulfuric acid (300 p.p.m. added gradually during test to maintain pH at approximately 6.5).

In another test, a coolant which contained 273 p.p.m. of chloride and which also had been made highly alkaline by the addition of sodium bicarbonate, sodium hydroxide, magnesium chloride, and calcium chloride, caused no more corrosion than the straight high-

chloride water of Fig. 1. The composition of the alkalized water in p.p.m. was: Chloride, 273; sodium, 158; calcium, 99; magnesium, 60; bicarbonate, 500. The pH was determined and found to be 9.1. It may be inferred from this that a water of low chloride content and of an alkalinity not greater than that of most naturally alkaline supplies would not be particularly corrosive to aluminum cylinder heads.

The only engine block tests which have been made in the presence of anti-freeze solutions were made with a mixture of dichromate and a glycol type of anti-freeze preparation in the cooling system. Probably none of the purely organic anti-freeze agents, such as glycol, glycerine, or alcohol, will noticeably affect the corrosion process. In other words, even in the presence of anti-freeze compounds, the corrosiveness of a coolant appears to be specifically a function of the chloride concentration.

In one engine block-test, using ethyl gasoline as a fuel, leakage of exhaust gas into the cooling water at the rate of ten liters per minute (0.5 per cent of the output of the engine) caused approximately as

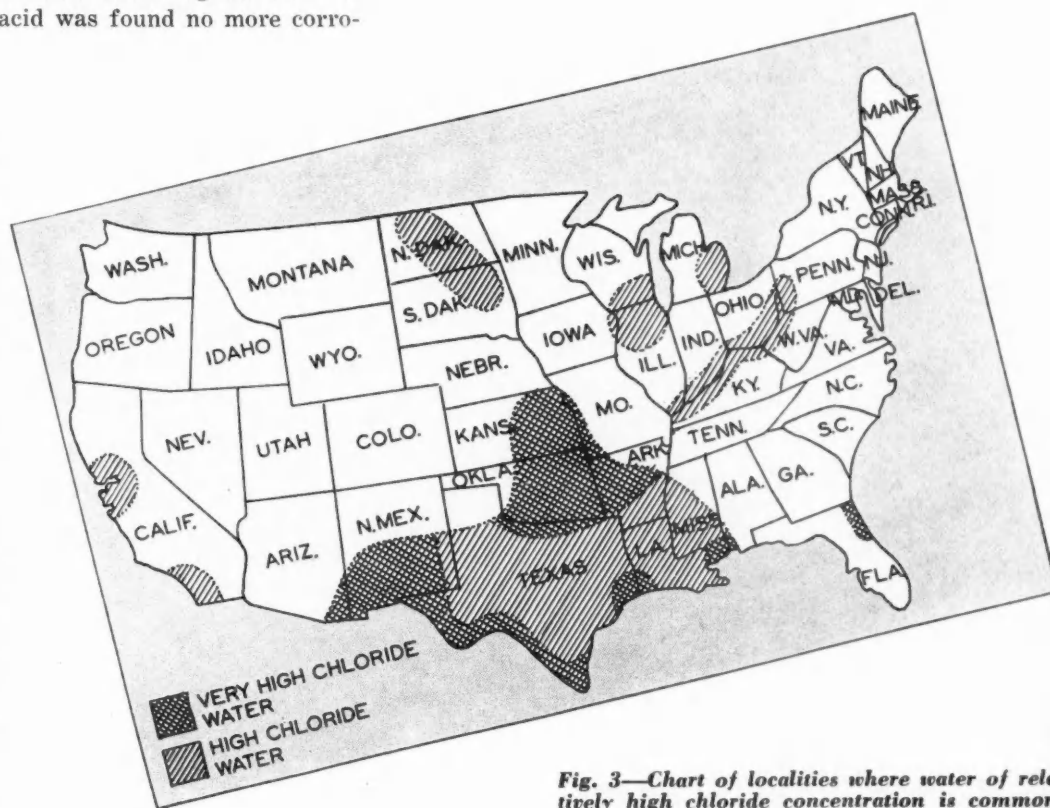


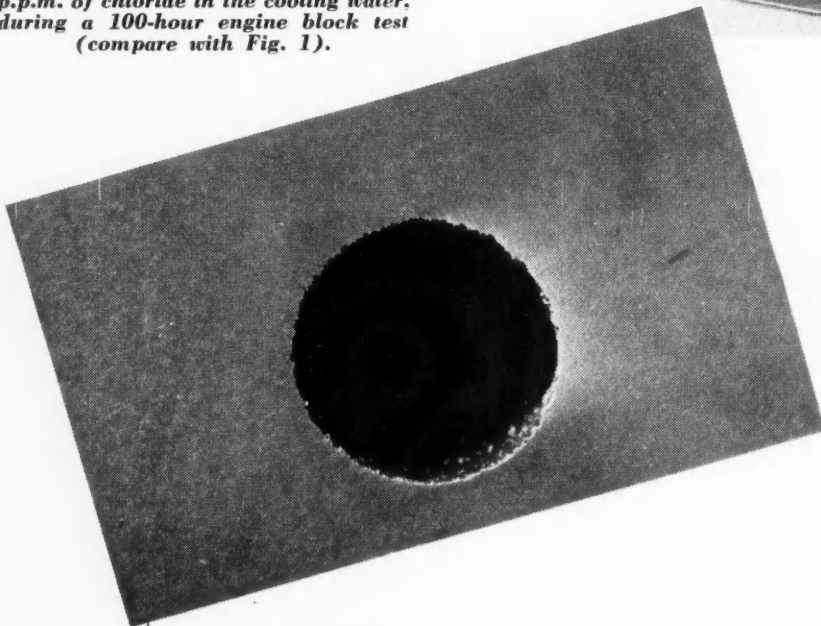
Fig. 3—Chart of localities where water of relatively high chloride concentration is common.

much corrosion as did a high chloride concentration. Under these conditions the bromide radical was found in the cooling water early in the test, and increased in concentration with running time. Tests indicated the coolant to be definitely reducing in chemical action, although only a trace of sulfite radical could be found. The presence of bromide, the reducing nature of the coolant, and the presence of large quantities of carbon dioxide are doubtless sufficient to account for the corrosion developed in this test. The chloride and sulfate concentrations and pH of the coolant were substantially unaffected. Exhaust gas leakage of even 1/10 this magnitude is probably rare in service, if for no other reason than the difficulty of maintaining engine operation under such conditions.

As previously indicated, erosion is an important factor in the corrosion process. Therefore, engine speed would be expected to affect corrosion, since the velocity of the coolant is roughly proportional to engine speed. Test runs at 4000 r.p.m. and 2400 r.p.m. with 273 p.p.m. of chloride in the cooling water were found to result in about equal amounts of corrosion. This indicated that speed is not a sensitive factor in the range above 2400 r.p.m., which is equivalent to 51 m.p.h. under the conditions of the test. However, there is probably a critical speed not far below 2400 r.p.m. where the rate of corrosion declines rapidly. This is indicated by the sharp reduction in corrosion caused by a mild constriction in the water flow in one of the tests at 2400 r.p.m. It is concluded that the driving rate may be an important factor in the corrosion of aluminum cylinder heads. Some drivers would exceed the critical speed more than others.

With high chloride concentrations, steel-asbestos gaskets were found associated with somewhat less corrosion than copper gaskets. However, where an effective inhibitor was also present there appeared to

Fig. 4—Protection provided by 1 per cent of soluble-oil inhibitor with 273 p.p.m. of chloride in the cooling water, during a 100-hour engine block test (compare with Fig. 1).



August 15, 1939

be no difference between the effects of steel and copper gaskets. Inspection of corroded heads from the field also supported the conclusion that the difference between the corrosion effects in the presence of steel and copper gaskets is of minor importance.

The zinc content of the alloy from which cylinder heads were made was found to have practically no influence on resistance to corrosion. A normal head

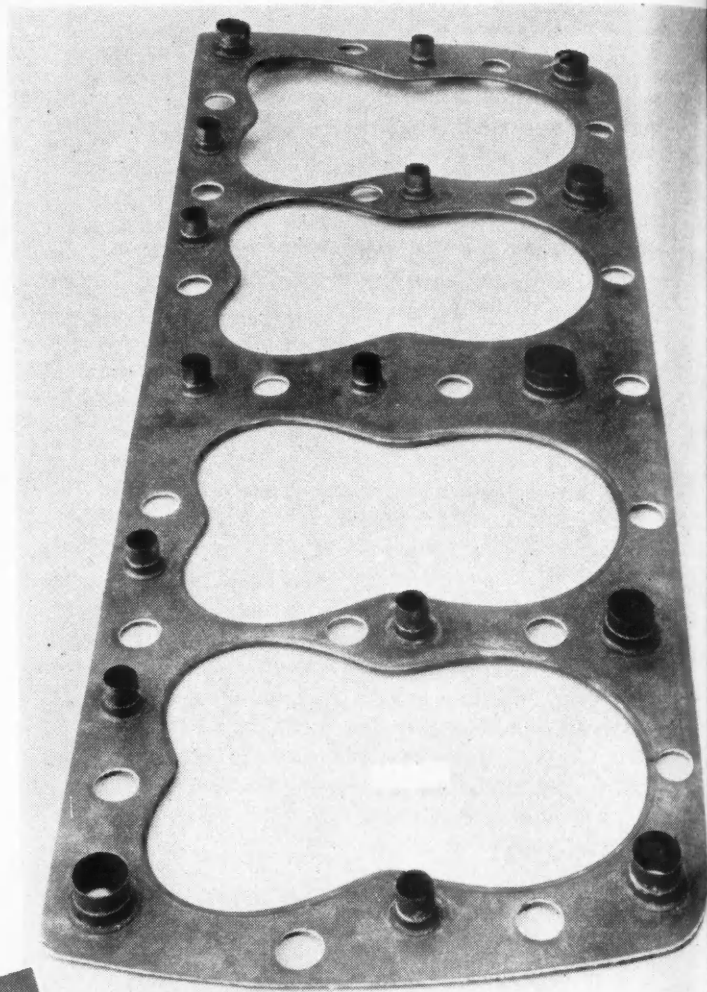


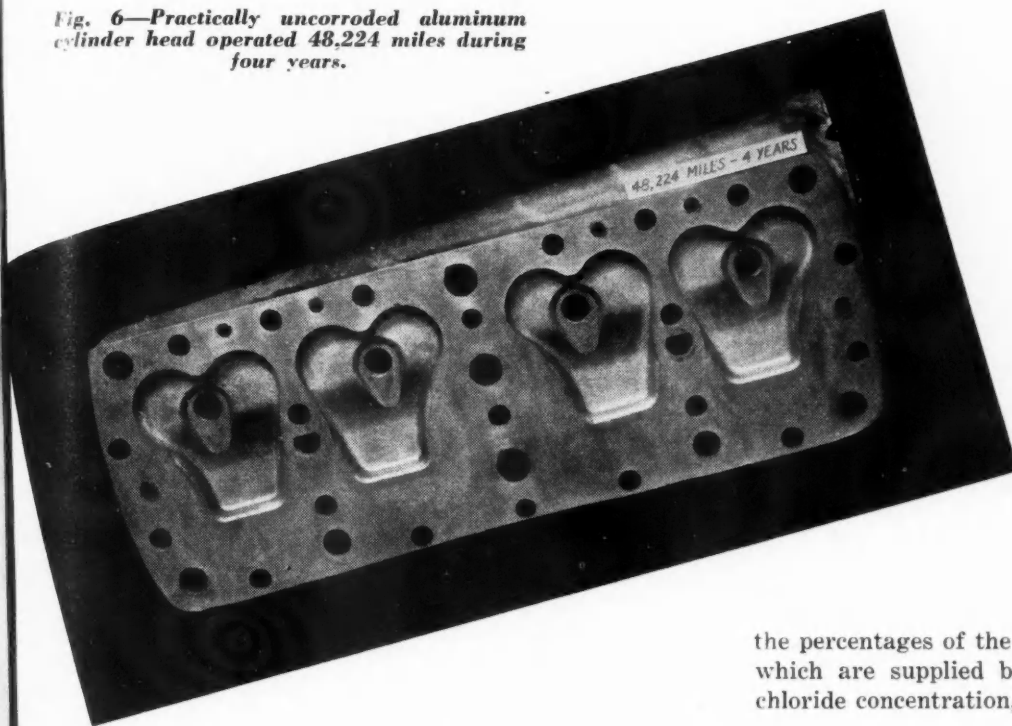
Fig. 5—A gasket made to fit the test engine which would cover the corrosion areas and extend into the water passages.

containing 1.81 per cent zinc was corroded no worse than a special head of similar composition with only 0.17 per cent zinc.

In a test made to investigate the claim that heat treatment makes aluminum heads susceptible to corrosion, a normal heat-treated 113 alloy head proved as resistant to corrosion as a similar head in the as-cast condition. Furthermore, examination of many corroded heads from the field indicated that alloy composition and heat treatment are not significant factors in the corrosion problem.

Automotive Industries

Fig. 6—Practically uncorroded aluminum cylinder head operated 48,224 miles during four years.



Sources of Chlorides

New cars as delivered from the factory have been found to contain more chloride in the coolant than might be expected. This hitherto unsuspected source of chloride probably explains a large proportion of cases of corrosion. The amount of chloride was determined recently in the radiator solutions of eight new cars. In each case it was known that the solutions had not been touched since the cars had left the factory. Half of the cars had not yet been delivered to the purchasers, and the other half had been driven only a few hundred miles. The eight determinations revealed an average chloride concentration of 82, a minimum of 39, and a maximum of 163 parts per million. When these values are compared with 14 parts per million or less for Detroit and Cleveland water supplies, and 273 for the high chloride water used in the engine block-tests, and when the results of the block corrosion tests are considered, it becomes apparent that the chloride introduced into automobile cooling systems prior to delivery to the customer is probably the major cause of objectionable amounts of corrosion. The source of this chloride is possibly radiator soldering flux, sal ammoniac used to seal porous cylinder block castings, or high chloride in water used for filling the cooling systems.

Other possible sources of chlorides are the various service preparations added to cooling systems, such as anti-freeze agents, cleaners, and anti-leak compounds. Fortunately, the occurrence of objectionable chloride concentrations in such materials is relatively rare.

It has been reported from the field that there is no well defined geographical factor in the cylinder-head-corrosion problem, and this has been advanced as an argument against the possibility that cooling water composition is a major factor. In view of all

the information now at hand concerning cylinder-head corrosion, it is apparent that there are many factors that would tend to obscure the geographical factor, chief among which is probably the chlorides in the cooling system of a new car at the factory.

It is true, however, that the chloride concentration of water supplies is considerably higher on the average in some parts of the country than in others. From the data published in Water Supply Paper 658 (1932) by the Department of the Interior, calculations have been made to show

the percentages of the population of the United States which are supplied by waters of various ranges of chloride concentration, with the following results:

Chloride Concentration in Water Supplies, Parts per Million	Per Cent of U. S. Population Served
0- 10	64
11- 20	20
21- 30	5
31- 40	4
41- 50	3
51-100	2
101-200	1
201-600	1

It appears that 4 per cent of the population may be using water which contains more than 50 p.p.m. of chloride, and it is the opinion of the authors that water in that range is definitely apt to cause corrosion difficulties with aluminum cylinder heads, if no protective measures are taken. Fig. 3 contains a map showing the localities where high-chloride water is prevalent.

The chloride concentration in water supplies is not uniform in any given locality. Many water supplies consist of a group of wells, and there is usually a wide variation among the chloride concentrations of the different wells. Water supplies which consist of filtered river water often vary considerably in chloride concentration with the seasons. For example, monthly composite samples of Ohio River water, which supplies a large population, showed 12 p.p.m. of chloride in April, 1932, and 70 p.p.m. in December, 1930.

Simple Methods of Prevention

The engine block tests have demonstrated that the objectionable corrosion which occasionally occurs with aluminum cylinder heads can be prevented by any one of three simple methods as follows:

- (1) Use of soluble oil in the cooling water;

(Turn to page 169, please)

The Lambert Brake

A DISK-TYPE of brake, known as the Lambert Safety Brake, has been developed by the Auto Specialties Co. of St. Joseph, Mich. It is already in production for use on farm tractors, and an automobile type has been designed and applied to several makes of cars, including a 1939 model Plymouth. This latter is represented by the drawing shown herewith. The brake consists essentially of four rings or disks, of which one turns with the wheel of the car, while the remainder are non-rotating, although one of them is capable of a certain angular motion. The brake ring carried on the wheel is made of malleable iron and is provided with friction linings on both sides, which are secured to it by ten rivets. Five driving lugs projecting radially from this ring are drilled to receive spring-steel grommets that slip over the ends of the driving

May Be Operated Manually or By A Hydraulic Mechanism

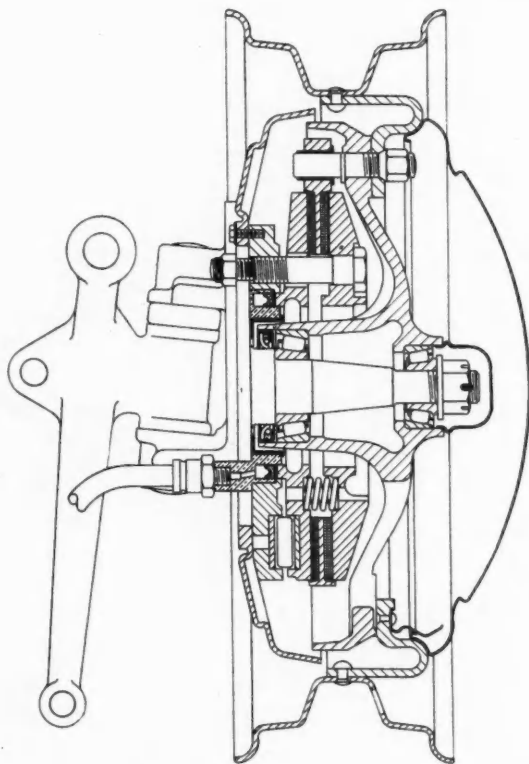
The two friction disks can be forced into contact with the central disk either by means of a mechanical pullrod or by an hydraulic mechanism, the latter being shown in the drawing. The fluid for hydraulic operation is confined in an annular channel to which the name "Collarfram" is applied. We understand that several changes have been made in the hydraulic mechanism recently. One or more cylinders are now being used, located near the circumference of the powerplate, the complete braking unit being assembled with three bolts, which also serve to mount the brake to the flanges of the axle spindle in front and the axle housing at the rear of the car.

Each friction lining has an effective area of 35 sq. in., so that the frictional area is 70 sq. in. per brake and 280 sq. in. per car. It is stated that when the brake is fully applied the total pressure on the frictional surface of one brake is 5400 lb., and that under these conditions a braking torque of 12,000 lb-in. is developed.

Application of the brake-operating pressure to the friction disks is through so-called power inserts. One of these inserts, that in the primary friction disk, is stationary, while the other, the one in the power plate, is capable of angular oscillations. These inserts have grooves containing rollers. The groove surfaces on which the rollers bear make an angle with the plane of the brake disks, and the braking effect produced by a certain pedal pressure depends upon this angle. As a rule, 30-deg. inserts are used for front brakes and 35-deg. inserts for rear brakes, which is said to give a braking-effect distribution of 55 per cent on front wheels and 45 per cent on rear wheels. The braking-effect distribution can be readily changed by replacing the inserts with others of different angle. The smaller the angle of the inserts, the greater the braking effect.

The action of the brake is as follows: As the primary friction disk is moved by the hydraulic pressure and comes in contact with the lined revolving ring, it is carried around with the ring, so that the inserts in the primary friction disk and the power plate move relative to each other and they in conjunction with the roller between them produce a wedging action which forces the two friction disks with greater force against the linings of the revolving friction ring.

Among the advantages claimed for the Lambert Safety Brake are that it contains fewer parts than conventional brakes and that the part moving with the wheel weighs much less than the conventional brake drum and hence has less angular inertia.



*Section through the Lambert Brake
fitted for hydraulic activation*

studs extending laterally from the web of the wheel.

The brake ring is located between two disks of gray iron which are normally held apart and out of contact with the brake ring by three coil springs exerting a pressure of 80 lb. each. The outer one of the two non-rotating disks, called the secondary friction disk, is supported from the flange of the steering knuckle or axle tube by means of three brake-adjusting and mounting bolts, while the inner one, the primary friction disk, is adapted to slide axially on a cylindrical seat concentric with the axle spindle.

MULTI-FUEL, POLY-CYCLE WAUKESHA ENGINE

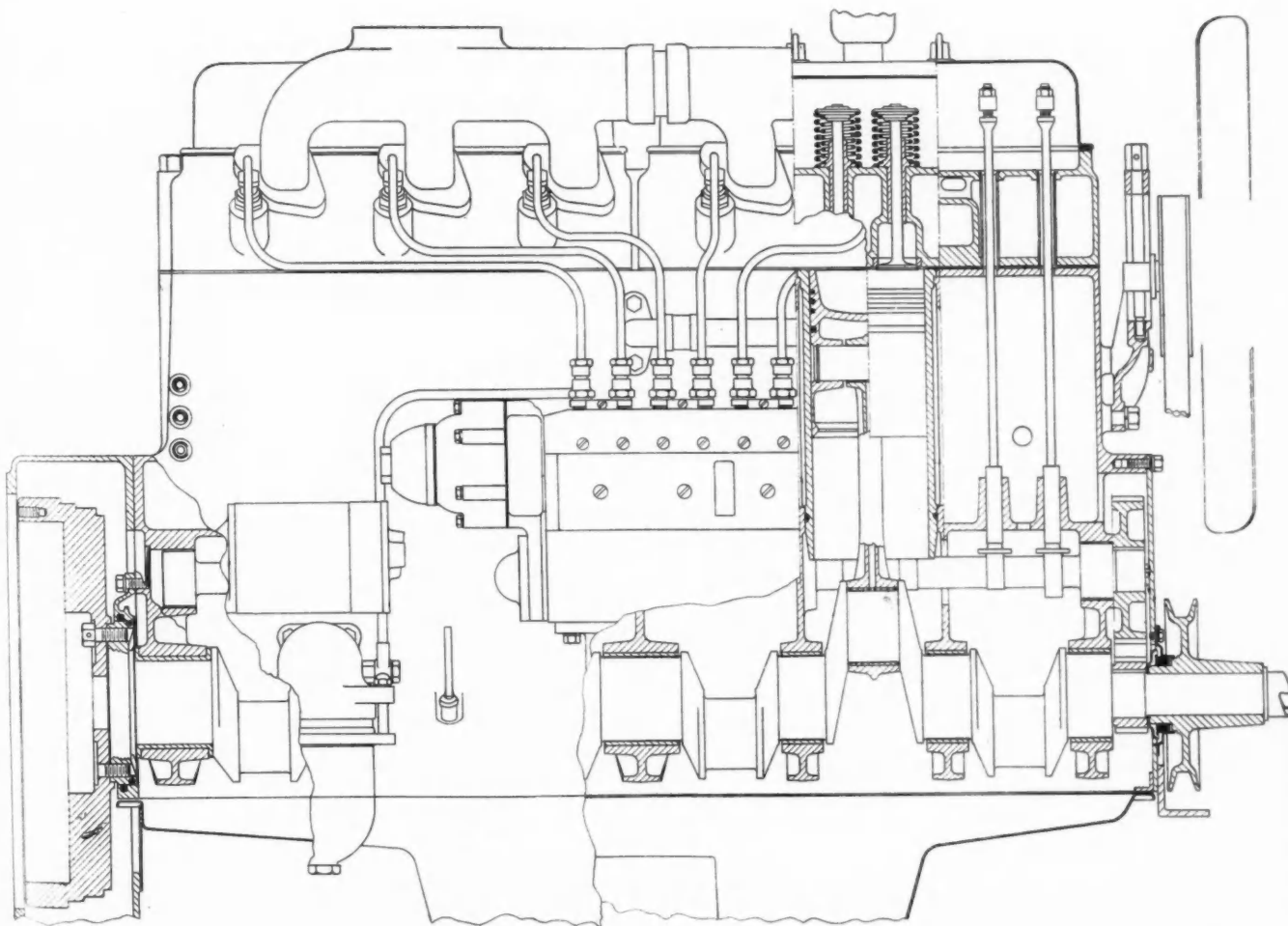
Longitudinal Section

IN THIS and the following page we print a longitudinal and a cross-section of the new Waukesha engine which can be used either as an oil engine with fuel injection or can be converted to operate as a gasoline engine or a gas engine. The engine here represented is a six-cylinder type of 4½-in. bore by 5½-in. stroke. For automotive uses it is governed at 2100 r.p.m. and then develops 125 hp., which corresponds to a b.m.e.p. of a little over 88 lb. per sq. in. The compression ratio is 5.8.

There are seven main bearings of 3 in. diameter. End thrust is taken up on the rear main bearing. The crankcase and cylinder frame are in a single casting which is provided with heavy diaphragms at top and bottom, as well as with baffles to control the

cooling water. Wet-type cylinder liners of Waukesha Moly-chrome iron are inserted in the block. Cylinder heads are twin castings and the water-cooled exhaust ports are cast integral with them. The two head castings of each engine are interchangeable. Injector nozzles and spark plugs are carried in the cylinder heads.

Pistons are of cast iron and have the peculiar form characteristic of the Hesselman engine, the cup-shaped combustion chamber being formed in the piston crown. There are four rings on each piston, all of which are located above the piston bosses. Piston pins float in the piston bosses and the small ends of the connecting rods, and are kept from drifting by snap rings inserted into grooves cut in the bores of



ENGINE DESIGN

MULTI-FUEL, POLY-CYCLE WAUKESHA ENGINE

Transverse Section

the piston bosses. The three compression rings are $\frac{3}{16}$ in. wide each, while the single oil-control ring is $\frac{1}{4}$ in. wide and is separated from the compression rings by a wider land.

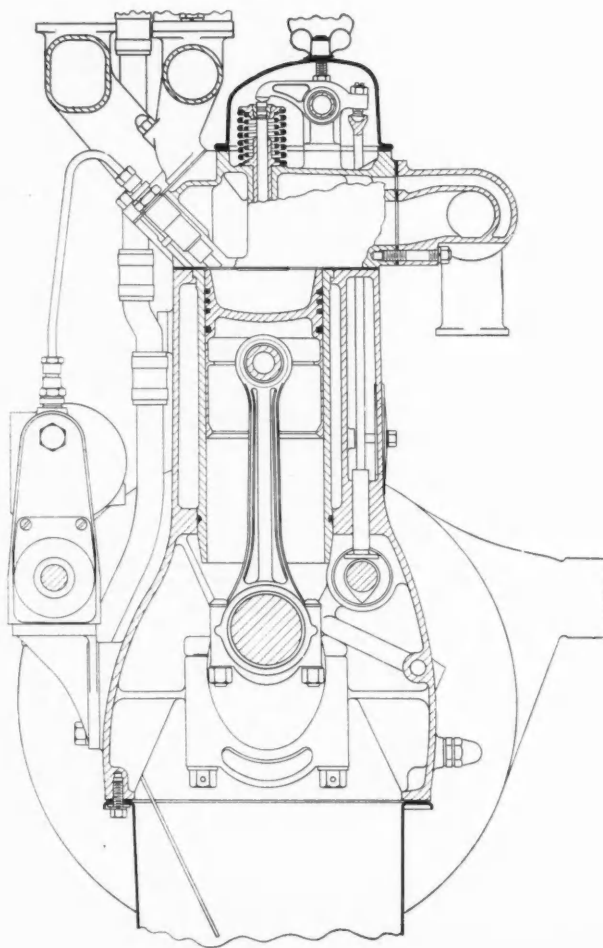
Connecting rods are drop-forged of 1045 steel and are rifle-drilled for pressure lubrication. Big-end bearings are $2\frac{3}{4}$ in. in diameter by 2 in. long. Crankshafts are cast of the alloy iron "Proferall." The aggregate length of its seven main bearings is $15\frac{9}{16}$ in. All main and connecting-rod bearings are of the steel-back precision type.

Intake valves are made of chrome-nickel, exhaust valves of silicon-chromium steel. The former have a port diameter of $1\frac{3}{4}$ and the latter of $1\frac{1}{2}$ in. The exhaust valve seats are provided with hard inserts

of heat-resistant material. Mushroom-type valve tappets are employed, and the entire valve mechanism is enclosed and flood-oiled. Helical timing gears of mild steel are used, with a face width of $1\frac{1}{2}$ in.

Cooling water is circulated by the usual centrifugal water pump. Internal baffles control the flow of the water through the jacket and ensure thorough cooling of the valve seats. Oil is forced through large drilled passages by a gear-type pump, to all main, camshaft, connecting-rod, piston-pin, and rocker-arm bearings, as well as to other miscellaneous bearings and to the cam gears.

An S.A.E. No. 3 flywheel housing is standard equipment on this engine. The weight of the engine equipped to operate on fuel oil is 1340 lb.



AUTOMOTIVE INDUSTRIES

Just among Ourselves

FEW parts of the motor car suffered so much from what may be called infantile diseases as did the pneumatic tire. For a good many years after its first application to passenger cars it was uncertain whether it would prove really practical in this service. Punctures and blow-outs were frequent, and the life of the tires seldom exceeded 3000 miles. A great deal of work was done on elastic wheels designed to make higher speeds possible with solid or cushion-type rubber tires, and the so-called motor buggy, which flourished for a couple of years toward the end of the first decade of the present century, also represented an attempt to make pneumatic tires unnecessary on motor-propelled road vehicles.

But finally the difficulties of design and materials were mastered. Inflation pressures were lowered, tire sizes were increased, average road speeds were raised, and the pneumatic tire became standard equipment for passenger cars. Next came the development of pneumatics for commercial vehicles, which began during the period of the World War. The practical solution of this problem assured the success of the motor truck and motor bus in long-distance services.

When pneumatic tires were first applied to farm tractors, about five years ago, it did not seem that this was a very promising field, for the peculiar quality of the pneumatic tire by virtue of which it "absorbs" obstacles over which it passes did not seem to be of any great advantage in a machine that usually runs over soft ground at a slow pace, and the cast of the pneumatic naturally runs quite high. Moreover, it seemed questionable whether sufficient traction could be developed with pneumatic tires under conditions that normally call for the use of driving lugs. However, the use of pneumatics for farm tractors has increased rapidly. All of the new models recently announced by the manufacturers, and also all of the tractors recently submitted to official tests in Nebraska are equipped with them. One great advantage of the pneumatic for farm tractors is that it permits driving of the machine over the highways at reasonable speed, in comfort, and without injury to the pavement. Most of these newer tractors are provided with a gear speed considerably above the practical limit for plowing or similar field operations. By thus adapting the farm tractor for use on the highways, its field of usefulness is increased and it can be kept busy a greater part of the year. True, the problem of taking care of the maximum driving force of the engine in low gear has

caused some difficulty. The maximum traction which can be produced is directly proportional to the load on the drivers, and provisions are now generally made to increase this load, when necessary, by attaching iron weights directly to the driving wheels or by filling the tires partly with water or anti-freeze solution.

This conversion of the farm tractor to a rubber-tired machine should benefit both the tractor and the tire industries. The widening of the fields of application of the tractor will increase the market for it, while the tire industry has in the farm tractor an entirely new outlet for its products.

Outlook for Diesel Dopes

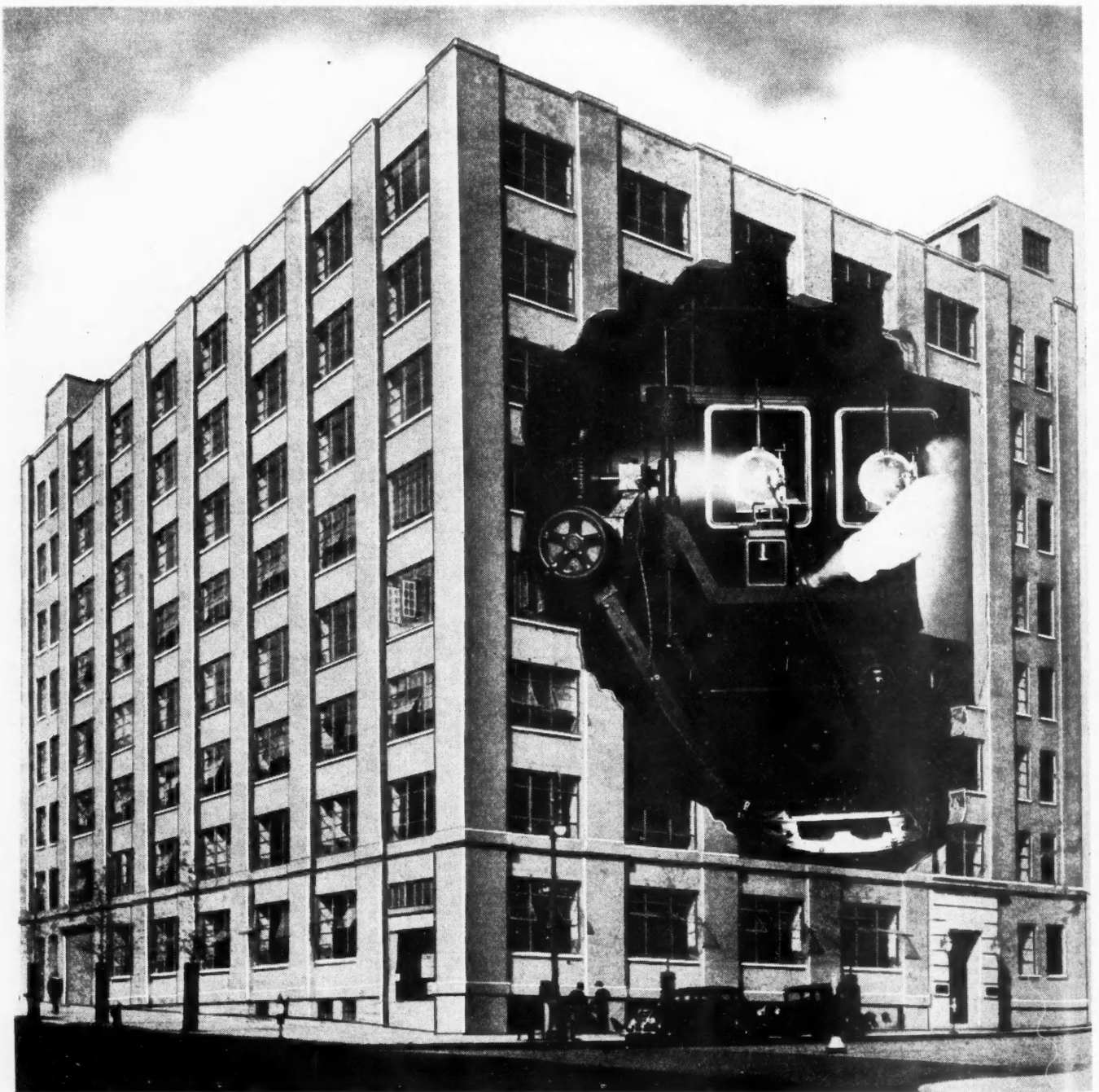
From recent discussions before technical societies, from the patent records, and from other evidence it appears that much work is being done at the present time with a view to the discovery or development of dopes for Diesel fuels, especially by concerns engaged in the organic branch of the chemical industry. But it also seems that no dope has yet been discovered which compares in effectiveness and all around satisfactoriness with tetra-ethyl lead for gasoline. One thing that renders the problem particularly difficult is that Diesel fuels sell at considerably lower prices than gasoline, hence the increase in cost due to the addition of the dope is likely to be considerably higher, on a percentage basis. Now, low fuel cost is practically the only reason for the existence of the Diesel engine, and to be acceptable, a dope for Diesel fuels must not lower this fuel-cost advantage to any considerable degree.

Whereas in the gasoline-engine field the improvement in fuels made possible by the addition of dopes, has been taken advantage of to increase the compression ratio, thereby increasing both the output and the fuel economy, the discovery of a similarly effective dope for Diesel fuels would be taken advantage of to burn fuels of low ignition quality—and therefore low in price—by bringing their cetane numbers up to the minimum required for satisfactory combustion in these engines. In a Diesel engine the compression ratio is not limited by the fuel quality, and, moreover, an increase in the compression ratio over that normally used in Diesel engines offers little advantage from the standpoints of output and fuel economy.—P. M. H.

Electrical

Cooperating with state authorities and the A S A this 42 year old organization is a potent factor in standardization

The new Electrical Testing Laboratories building in New York. The inset shows mounting trunnion and projection range for measuring beams from automobile headlamps.



August 15, 1939

Automotive Industries

Testing Laboratories

ABOUT six years ago when the American Standards Association was preparing specifications for automotive safety glass the sub-committee in charge of this activity turned over the work of determining the effectiveness of their tentative standards to Electrical Testing Laboratories. It was a logical choice inasmuch as ETL had been active for some years previously in making acceptance tests of glass submitted to various state regulatory bodies. Today, as a result of the co-operative work of the association, and ETL, virtually all states which have been required by law to issue specifications for glass installed in motor vehicles coming under their jurisdiction now use the American Standard Specifications. The rigorous nature of the routine now used for testing safety glass at ETL is indicated by the following description of an investigation made recently on three specimens of a well-known make of tempered plate glass. The procedure was in accordance with the American Standard Safety Code for Safety Glass for Glazing Motor Vehicles Operating on Land Highways.

The safety glass first was subjected to a discoloration test. Three specimens were mounted at a distance of 9 in. from a source of ultra-violet radiation equivalent to that of a "Uviarc Test Cabinet" or "Laboratory Outfit" of the 220-volt Cooper-Hewitt type. The material under test was exposed to the radiation for 100 hr., during which time the temperature of the specimens was maintained between 100 and 120 deg. Fahr. The specimens were tested for transmission of light from a source having a color temperature of approximately 2900 K, before and after exposure to the ultra-violet radiation. Then the three pieces of glass were immersed for three minutes in water at a temperature of 150 deg. Fahr. This was followed immediately by a 10-minute immersion in boiling water. The specimens were removed and visually inspected.

In a humidity test, three specimens were kept for two weeks in a closed container over a saturated aqueous solution of sodium nitrite. The relative humidity amounted to about 70 per cent. Temperature of the air in the container was maintained between 115 and 125 deg. Fahr.

Specimens also were submitted to a boil test and immediately after were immersed in boiling water for two hours.

Each of 10 specimens was supported in a wood frame and a ½-lb steel ball was dropped from a height of 10 ft., striking the specimen within 1 in. of its center. The test was repeated with the same 10 pieces of glass, the height from which the ball was dropped being increased by 12 in., increments until the glass broke.

Finally, four pieces of the glass were subjected to a shot bag test. Each specimen was supported in a wood frame and an 11-lb. shot bag was dropped from a distance of 8 ft., also striking the specimen within 1 in. of its center. Each of these specimens had been kept at room temperature (approximately 72 deg. Fahr.) for at least four hours immediately preceding this test.

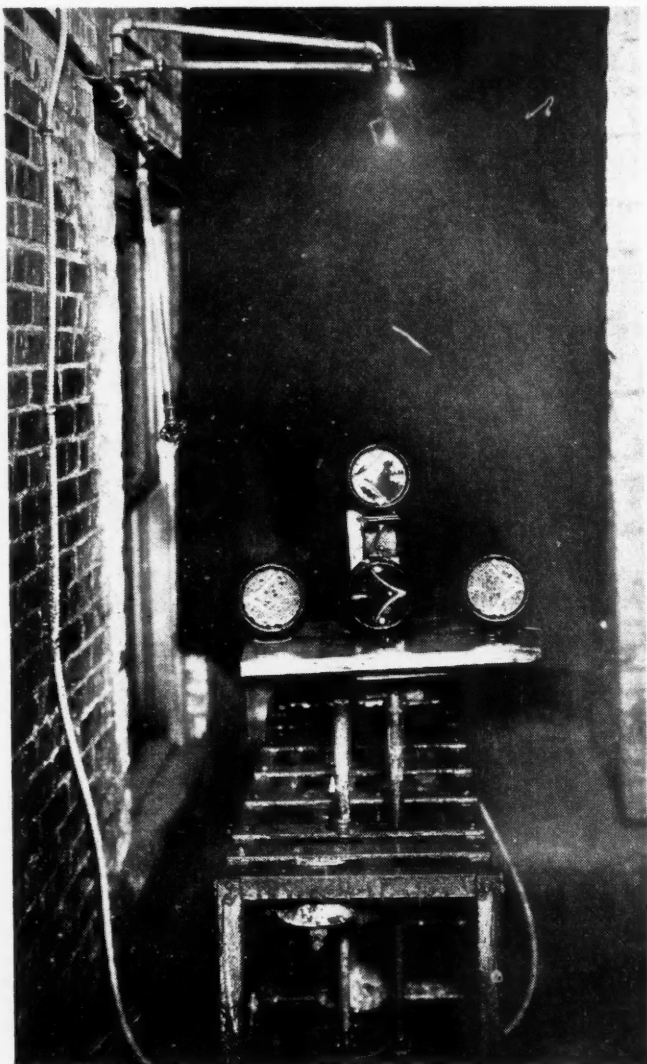
Another excellent example of the type of work carried on in the automotive field at ETL is the method of investigating the commercial acceptability of motor-vehicle direction signals. The procedure of a recent test on two signals of the illuminated-arrow type first called for measurements of light intensity to be made in accordance with "Specifications for Laboratory Tests of Optical Characteristics of Electric Signal-Lamps for Motor Vehicles," a procedure recommended by the Society of Automotive Engineers. The mechanical

construction of the signals was then investigated. Signals were bolted to a mounting plate, attached to the table of a specially designed vibration machine, and vibrated for two hours at the rate of 1100 vibrations per min. This test was extremely severe, the signal being put through a cycle con-



Integrating sphere, equipped for making observations by means of photocells instead of personal observation, for measuring light output from incandescent lamps. This sphere is used for making such measurements of automotive lamp bulbs.

TESTING



(Above) Weatherproof (rain) test of directional signals. The precipitation rate is 0.1 in. per min.

Machine for making vibration and shock test of automotive signalling devices.

sisting in raising the assembly $\frac{1}{4}$ in. and dropping it so that two hardened steel calks on the table jarred violently against an anvil. During the test each signal was frequently inspected for evidence of electrical or mechanical failure. The set-up for this part of the test is shown on page 767.

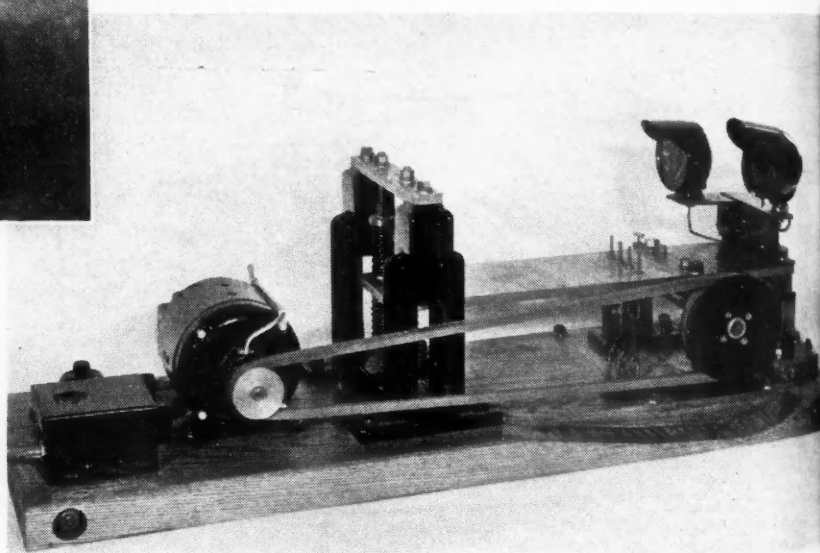
Following the vibration test, a test was made to determine whether the devices were dustproof. The procedure entailing measurements of the optical qualities of the devices before and after they had been subjected to dust. The signals were placed in a box measuring 16 in. wide by 12 in. deep by 20 in. high. Commercial cement was placed in the box, in the proportion of 5 oz. per cu. ft. of box volume. The cement was so fine that not more than 22 per cent would be retained on a 200-mesh sieve. For seven hours, compressed air was blown into the box every 15 min., in a manner to thoroughly agitate the cement powder.

August 15, 1939

Subsequently water was sprayed onto the signals for 24 hours at an angle of 45 deg., with a precipitation rate of 0.1 in. per min., while the signals were being rotated at 4 r.p.m. to determine if they were water-proof. (See photograph on this page.) At this juncture the light bulbs and the method of replacing them were carefully checked.

Finally, daylight visibility was investigated. The procedure called for setting up the signals outdoors about the middle of the afternoon on a clear day. The face of each signal was vertical and arranged so that it faced the sun. Seven observers, to whom the type of signal was unfamiliar, were stationed at a distance of 125 ft. and asked to watch the signal and report what they saw. Night visibility was investigated in the same manner, except that the tests were conducted in a dark room.

The services of ETL are employed frequently by state motor vehicle authorities. In fact, in a number of states tests made by ETL are the basis for approval or rejection of automobile lighting equipment. Facilities of the Laboratories for measuring candlepower and determining performance characteristics of various designs of headlamps were utilized a number of years ago by the Eastern Conference of Motor Vehicle Administrators. This body continues to use



ETL reports in making decisions as to the acceptability of various types of automotive lighting accessories.

Manufacturers of headlamps also seek the counsel of ETL's technical staff. Some wish to have a new product tested in order to find out if it conforms to specifications; others, who are producing a product already accepted and have found it necessary to cut new lens molds or replace punches and dies, wish to know whether their product still meets requirements.

A large dark room is used for this work, the headlamps being mounted on an adjustable stand which is shown on page 164. The test technique involves projection of the beam onto a distant screen; focusing,

Automotive Industries

adjusting, and aiming the headlamps, and measuring the candle-power.

Mechanical tests include investigations of the endurance and reliability of adjusting mechanisms, the effect of continued vibration, the degree to which the devices are waterproof and dustproof. Photographs of the headlamp and the beam it produces are included in the final report.

On this page is a photograph of a recently installed wind tunnel for studying the performance of kerosene road flares under conditions simulating outdoor operation. Air movements corresponding to wind velocities up to 45 m.p.h., measured with a pitot tube and draft gage, are employed. The blower system is equipped with a table which can be rotated so that the flares may be observed in various upright positions with respect to the direction of the wind. Two photoelectric cells used for measuring the light output of the flares are built into the tunnel. These cells are arranged so that the light can be measured at right angles to the wind and also with the wind. Later the kerosene flares are subjected to a severe rain test.

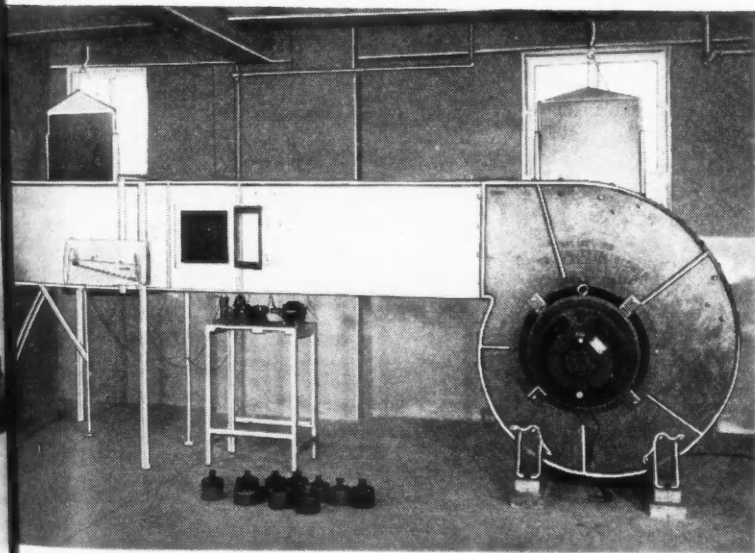
Other types of automotive equipment tested at the Laboratories include license-plate lamps, switches, bulbs, reflectors, tail lamps, clearance markers, spot, fog and identification lamps. Considerable work is

tained from which curves are plotted. These curves give a definite measure of the color permanence of a finish. Such tests permit manufacturers—or purchasers—to determine in advance how a finish will retain its appearance over a period of service.

The instrument is especially valuable where it is desired to duplicate colors. As it will determine the relative proportions of color in a sample, permanent records are obtainable with which successive samples may be compared. If samples of another batch of material vary from the original, the instrument indicates the components which must be added or deleted.

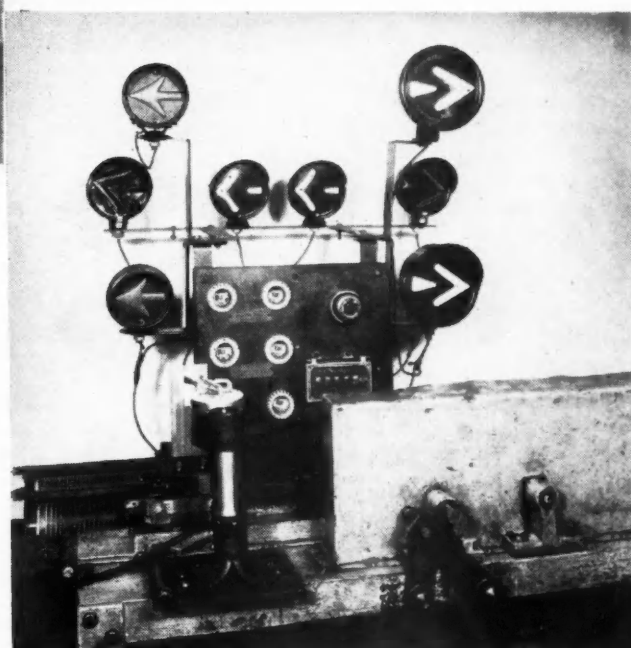
Although the testing of automotive equipment is one of the major activities of the Electrical Testing Laboratories, Inc., this unusual organization investigates virtually "everything under the sun" from curling irons to bank notes. Equally diverse is its clientele, which includes not only manufacturers, but also inventors and investment companies. ETL, by its own definition, is "an independent corporation to which anyone may bring a single piece of equipment for examination, or may arrange for a year of research or field study. Its raw materials usually are the manufactured articles of industry; its finished product, test data concerning strength, safety, durability, efficiency, performance, and general suitability of such articles."

Fourteen laboratory departments are housed in the corporation's new quarters—an eight-story building at East End Avenue and Seventy-ninth Street, New York. These include the electrical, chemical, mechanical, paper testing, high-voltage, and radio laboratories; departments for testing



(Left) Wind tunnel used in making wind tests of kerosene flares. The tunnel is equipped with two photocells for measuring light output.

(Below) Machine for making endurance tests of switches. Direction signals furnish the load.



done also on street- and highway-lighting equipment.

One of the most recent acquisitions of the Laboratories is a recording spectrophotometer designed to measure the spectral transmission or spectral reflection characteristics of various materials, such as automotive finishes. The instrument makes possible the determination of the effect on finishes of such factors as heat, light, ultra-violet radiation, humidity, and surface grease. The procedure in an investigation of this kind is to first prepare a number of samples. The reflectance values of these samples are measured. Then, the behavior of each sample under the effects of one of the aforementioned factors is investigated. As a final procedure, a number of reflectance values are ob-

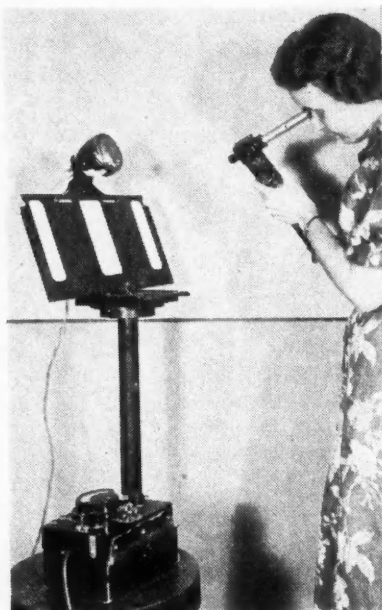
cables, incandescent lamps, household appliances, rubber insulating equipment; rooms for refrigeration, air-conditioning, and photometric investigations. While the foregoing are established as separate departments, all may be utilized for problems which require their facilities. The corporation also maintains a field force of about 25 men available in the principle cities of the United States for testing and inspecting equipment.

In the electrical laboratory tests are performed on apparatus used for generating, transforming, distributing, storing, or utilizing electrical energy. Integrating, indicating, and recording instruments are calibrated. Voltages up to 500,000 can be produced for this work—currents up to 1000 amp. at 120 volts, and up to 20,000 amp. at 3 volts. Field-service men conduct the tests on equipment which may be either in service or too large to be brought into the laboratory.

Investigations conducted in the mechanical laboratory consist of the testing of materials for hardness, resistance to tension, compression and torsion stresses, abrasion, impact and bending. Equipment is available for making tensile and compression tests up to 200,000 lb., and for torsion tests up to 230,000 lb.-in. Such tests can be made over a wide range of temperatures.

Photometric testing embraces investigations of a wide variety of illumination devices, including automotive lighting equipment. This branch of ETL serves as the certifying agency for portable lamps built to comply with the Illuminating Engineering Society's specifications; it also has been testing and certifying RLM reflectors for a number of years. A well-equipped radiometric and spectrographic section augments the department's facilities.

The radio laboratory test work comprises measurements of inductance and distributed capacity of coils, capacitance of condensers, electrical and mechanical properties of insulating materials; also, determinations of impedance of equipment such as choke coils,



Measuring the illumination upon a simulated automobile license plate from a combination tail light fixture.

and studies of the characteristics of vacuum tubes.

Complete analyses of a wide range of engineering materials can be made in the chemical laboratory. In addition to facilities for work such as making accelerated aging and corrosion tests, a complete photomicrographic laboratory extends the scope of investigations which can be made in this field.

In the high-voltage laboratory, voltages up to 500,000 either at 60 cycles or at 200,000 cycles are available for the testing of cable, insulators insulating material, and many dielectric liquids. Proof tests and breakdown tests are made on complete equipment or component parts.

Incandescent lamps are tested on an extensive scale. Each year ETL burns to destruction more than 15,000 lamps, representing a factory output of approximately 350,000,000 to determine the average life of the lamps produced by the manufacturers. Three principal qualities are determined: The physical condition, the initial rating, and the life performance.

Electrical Testing Laboratories was organized 42 years ago by several electric light and power companies as the Lamp Bureau of the Association of Edison Illuminating Companies. Its function was simply to conduct tests on incandescent lamps purchased by the member companies. Not until 1904 was the bureau incorporated under the name of Electrical Testing Laboratories.

While ETL branched out into other fields about 20 years ago, it continues to test lamps for the utilities and lamp manufacturers. The \$1,000,000 corporation now has an operating personnel of approximately 175 persons.

ETL's first president was John W. Lieb, vice-president of the New York Edison Co., who served as the Laboratories' head until his death in 1929. Preston S. Millar succeeded him as president. F. Malcolm Farmer is vice-president and chief engineer.

A Controllable Overdrive

A CONTROLLABLE overdrive has been developed in England by Capt. E. J. de Normanville. It consists of an internal-gear-type of planetary gear with which is combined a double-acting conical friction clutch, the latter being adapted to engage either with a conical surface on the outside of the internal gear of the planetary assembly or with a female cone secured to the housing of the overdrive. Normally the clutch is held by a spring in engagement with the internal-gear ring, and the planetary is then locked and the

drive is direct. By pulling out a lever the driver admits oil under pressure to a pair of hydraulic cylinders, thereby disengaging the clutch from the internal gear ring and bringing it in contact with the stationary cone. The sun pinion of the planetary assembly is then held from rotation and the car speed is stepped up for a certain engine speed. The overdrive can be engaged only when the transmission is in direct drive and is automatically disengaged when the driver shifts to a lower gear.

Corrosion Resistance of Aluminum Cylinder Heads

(Continued from page 159)

tain the head. If more than two or three studs on a head are stuck, removal of the head is apt to be troublesome. If mild rapping, prying, and wedging fail, removal of some of the stuck studs becomes necessary. If enough of the stud protrudes, it can be removed by means of a jam nut; otherwise the use of a pipe wrench or some other method destructive to the stud may be necessary. Soaking with paint remover has been recommended for freeing stuck studs. In some cases sticking is due to peening in of the upper rim of the stud hole, due to the use of washers which are dished, too thin, or too narrow, etc. Difficulty in the removal of heads from engines with studs can be largely eliminated by observance of the following details at the factory and in the repair shop:

(1) The stud washer should be a large, thick, machined washer, perhaps $\frac{1}{8}$ in. thick and as wide as the stud boss.

(2) The stud holes should be at least $\frac{1}{16}$ in. greater in diameter than the studs, with the possible exception of the two studs which may be used to locate the head. The use of dowels for location is preferable.

(3) The studs should be greased before applying the head.

(4) The stud nuts should be kept tight not only to preserve compression, etc., but also to prevent water leakage into the stud clearances.

Conclusions

On the basis principally of these data obtained from the investigation described in the foregoing, it is believed the following conclusions are justified:

1. The major force in the corrosion of aluminum-alloy cylinder heads is the composition of the cooling water. High chloride concentrations are relatively much more corrosive than abnormally high concentrations of other salts commonly occurring in natural waters.

2. Amounts of chloride large enough to cause objectionable corrosion of aluminum cylinder heads are often present in automobile cooling systems when the cars leave the factory. The source may be soldering flux or sal ammoniac used for sealing porous castings, etc. This source of corrosion probably accounts for the majority of corrosion complaints from the field.

3. The erosion caused by the direct impingement of water of high velocity on exposed aluminum surfaces also is a major factor in the problem.

4. Control of operating conditions so that either (1) or (3) is eliminated is apparently sufficient to reduce the problem to negligible proportions.

5. Elimination of (3) by adequate gasket design is apparently easily achieved.

6. Even in the presence of both (1) and (3), corrosion can be greatly reduced, if not practically eliminated, by using soluble oil as a corrosion inhibitor.

7. Cylinder-head alloy and temper, and gasket material are relatively insignificant factors in the corrosion of aluminum cylinder heads.



In order to give readers of *AUTOMOTIVE INDUSTRIES* a clue to certain merchandising and service aspects of the automotive industry which are normally outside the scope of an industrial publication, we present herewith excerpts from the August issues of the other magazines published by the Automotive Division of the Chilton Co.

From Commercial Car Journal

The "Self-Liquidating Project Act of 1939," recently introduced in both houses, incorporates an item of \$750,000,000 for use by the Public Roads Administration for the construction and maintenance of highways. The bill would authorize the collection of tolls sufficient to amortize the cost of the highways. Amid other operating details, the bill would empower the administration to use the right of eminent domain in acquiring the right of way and would empower it to purchase but not condemn adjacent land for speculative purposes.

From Motor Age

Although tragedy threatened to remove the American member from the world's "big three" super-speed drivers when Ab Jenkins was reported seriously burned July 26 at Bonneville Saltbed, John Cobb, the English ace, will begin his assault on Captain George Eyston's mile record in mid-August. He is expected to begin his attempts on Aug. 15 or a week later. However, it was predicted that he would not get into the peak speed gait until late in the month.

Eyston, who holds the existing mile record of 357.5 m.p.h., plans a new assault on the mark in 1940 with a revamped car.

From Automobile Trade Journal

There are approximately 44,000 car dealers in the United States. While no actual count has been made, it would not be far wrong to say that the number of salesmen employed by these dealers is about 100,000.

In 1938, in the United States, 2,256,370 passenger cars and trucks were sold. Dividing 100,000 salesmen into that number we find that each salesman averaged something over 22 cars and trucks per year. The average commission from the sale of a passenger car should be about \$40, and as passenger car dealers who also sell trucks sell the low-priced makes, about the same commission should apply on trucks. Hence, if the average salesman sells from 21 to 23 motor vehicles annually, his annual total take should be \$840 to \$920; or from \$16 to \$18 per week.

THE accompanying drawings show a transmission for passenger cars laid over on its side, as it were, which permits of a very low floorboard and a somewhat lower mounting of the transmission without reducing the road clearance. Where in the conventional transmission the countershaft is located directly below the mainshaft, in this design it is practically in the same horizontal plane, and to the right. A mounting plate on the left-hand side provides for the shifting mechanism for operation in conjunction with remote control (by a column-mounted shift lever). Gear shifting is accomplished by means of two shift bars of rectangular section, to which the shifter forks are riveted, and through the medium of a walking-beam type of linkage. All shifting is accomplished by means of a single external lever arm. The small lever arm shown just ahead of the shifter arm serves to select either the high-speed rail or the low-speed rail. This selecting lever operates a finger within the transmission, which engages a notch in one rail or the other, and prevents the engaged rail from moving. The walking-beam linkage will shift the rail that is free to move.

A blocker-type synchronizer is shown on the main shaft between second and high. Bronze synchronizer cone rings are carried in a hub mounted on the main shaft of the transmission, the hub having teeth around its circumference. A sliding ring with corresponding teeth also is carried on the hub, and is shifted by the shifter fork. The ends of the teeth on the ring are chamfered to match chamfers on similar teeth on the synchronizer rings and also on clutch teeth formed on the second-speed and high-speed gears respectively.

Carried in slots in the hub member are three rectangular bars which engage against the bronze synchronizer rings. Slots are provided in the top of the rectangular bars, through which passes a spring ring. When the outer toothed sleeve is moved axially, this spring ring produces a drag between the outer ring and the bars, pushing them in turn against the bronze synchronizer rings and starting the blocker servo action. The synchronizing action is completed by the ramps on the chamfered teeth.

The effort required to move the synchronizer is said to be slight, so that a light finger action suffices to accomplish the gear shift.

Secured to the rear of the transmission housing is the Warner Gear Company's automatic planetary overdrive with solenoid-operated driver control. In the forward (left) part of the overdrive housing there is a planetary gear train, the sun gear *A* of which is normally held from rotating by a pawl and ratchet mechanism. The main transmission shaft *B* drives the planet pinion cage *C* and the internal gear *D* is the driven member. In driving connection with ring gear *D* is a mounting which carries centrifugal driving pawls *E,E*. These pawls are held in their inward posi-

tion by springs, but when the car attains a speed of 30 m.p.h. or so in direct drive, they are moved outward by the centrifugal force on them, and engage into openings in the sliding sleeve, *G*, which is in driving connection with the tailshaft *H*.

Immediately behind the centrifugal governor clutch is an over-running roller clutch, two of the rollers being shown at *I,I*. The internal or cam member of this over-running clutch is splined to the main transmission shaft *B* and the drum or driven member of the clutch is an integral part of the tail shaft *H*. At speeds below 30 m.p.h. the drive is taken through this over-running clutch, the planetary train then revolving idly. When the pawls of the centrifugal mechanism engage the sliding sleeve *G*, the planetary train comes into action, the driven gear ring *D* then being connected directly to tailshaft *H*. Since gear ring *H* turns faster than planetary pinion carrier *C* and main drive shaft *B*, the tailshaft now overruns the transmission main shaft and the car is in overdrive.

In the past an objection to the automatic drive has been that the driver could not get out of overdrive if

Warner Gear Designs and

he wanted to accelerate more rapidly than possible in that drive, without first slowing the car down to the cut-out speed, which is always somewhat below the cut-in speed. This objection is now overcome by the solenoid control.

The solenoid *J* is mounted on a member intermediate between the main transmission and the overdrive, the construction being shown in the lower right-hand corner of the drawing. The sun gear of the planetary train is held from rotation by a member *K* with slots in its periphery, with which the sliding pawl *L* is adapted to engage. The pawl is forced into engagement with the slotted member by a spring and is pulled out of engagement by energizing the solenoid.

If while the car is being driven in overdrive the driver desires more acceleration, he simply pushes the accelerator beyond the wide-open throttle position. The accelerator linkage then operates a switch to energize the solenoid *J*, and to also momentarily cut out the ignition, so as to take the torque off the pawl *L*, which is restraining the gear from rotating. The solenoid then pulls the pawl out of engagement and immediately restores the ignition, whereupon the transmission is in direct drive. It returns to overdrive if the driver takes his foot off the pedal and then presses down again. The gear ratio of the overdrive is 0.722 to 1.00.

In the drawing the sliding sleeve *G* is shown in its normal, forward position. By means of lever *M*, at the side of the overdrive housing, the sliding sleeve can be moved into its rear position, in which case the overdrive unit remains in direct drive continuously, internal teeth on the sliding sleeve then engaging with spur teeth on the cam member of the overrunning clutch. The overrunning clutch is then locked, and the openings in the sliding sleeve are out of line with the centrifugal driving pawls *E,E*. Locking out of the overdrive is accomplished by means of a knob on the instrument panel.

When the pawls *E,E* move out into the driving position, they automatically lock the free-wheeling unit constituted by the over-running clutch, so that whenever the car is in overdrive, a two-way drive is obtained and the car will coast against the engine on a down-grade. In other words, the free-wheeling feature is operative only when the car is below the cut-in speed, which means, in city-traffic driving.

With the introduction of the solenoid "kickdown" feature, the cut-in speed for overdrive has been mate-

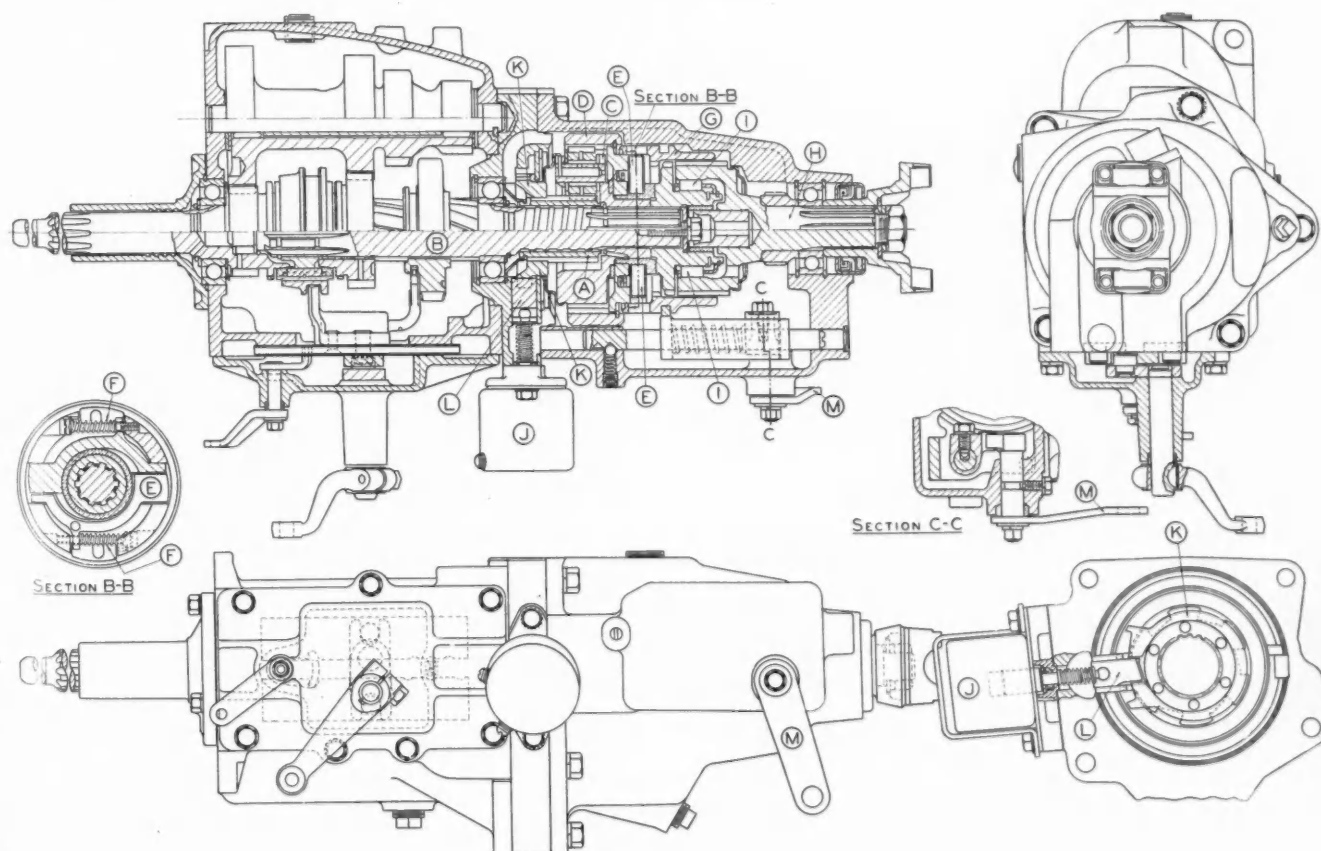
rially lowered, to around 28 or 30 m.p.h. The cut-out speed is several miles below that. This means that in descending hills, the car in overdrive will coast against the engine to speeds down as low as 22 to 25 m.p.h. If the speed drops still further and the car goes into direct drive, it is easy to hold it with an occasional snubbing of the brakes, and there is then little need for the free-wheel lock-out feature.

The free-wheel lock-out knob on the dash cannot be pulled out when the car is in overdrive, as in that case the free-wheeling unit is locked already. The unit must be locked while the car is free-wheeling and is below the cut-in speed. It is accomplished by opening the throttle slightly and then pulling out the knob. This results in a smooth and easy engagement, and the clutch should not be released. When going back into free-wheeling, the knob is pushed toward the instrument board without disturbing either the throttle or the clutch.

The drawings below show a horizontal section through the transmission and overdrive, a side view, an end view, and a number of detail views.

s "Roll-Over" Transmission

d Automatic Overdrive



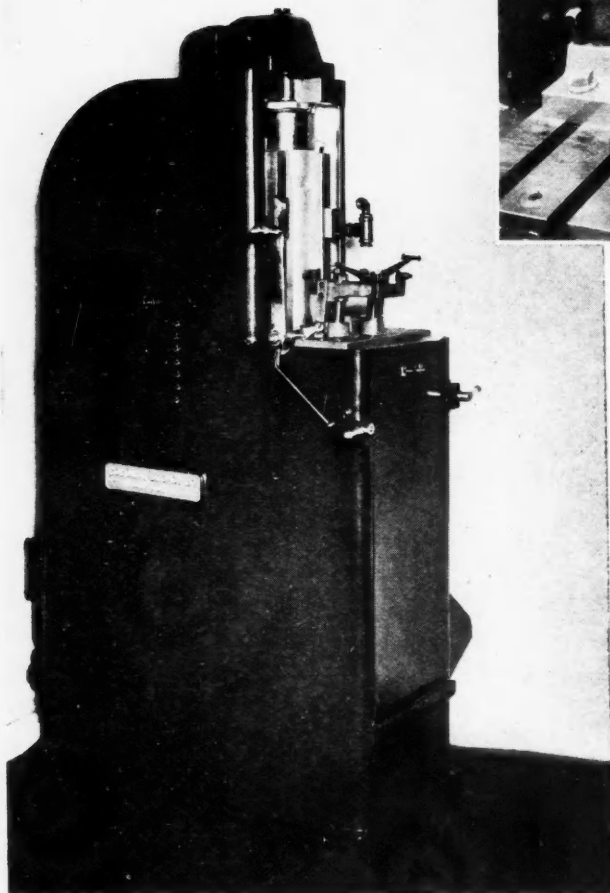
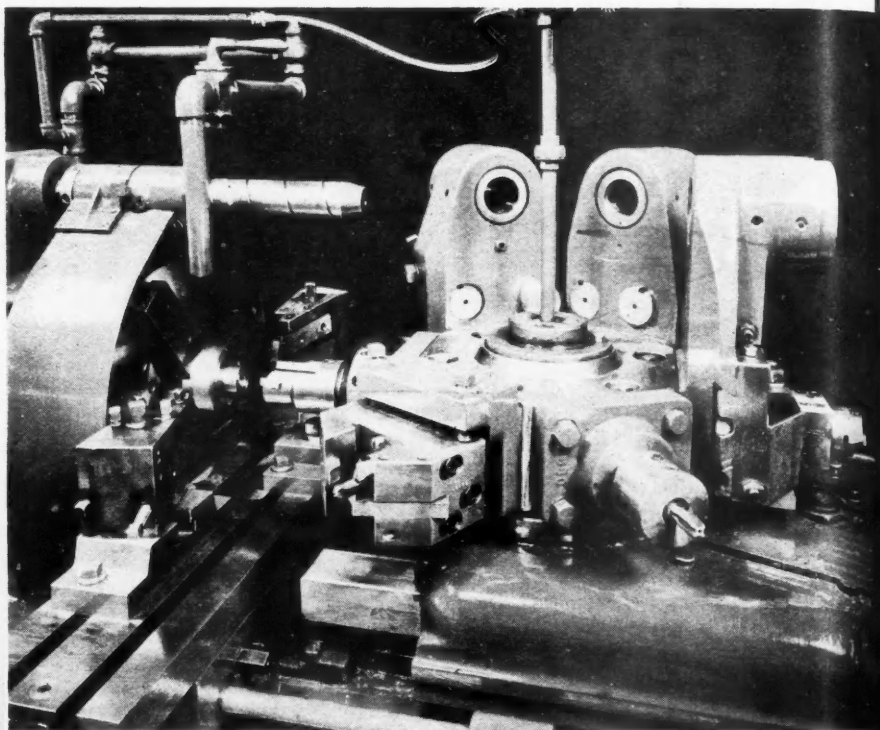
TRANSMISSION DESIGN

MEN and MACHINES . . .

W. F. Ridgway Has in Selecting Electric

(Right) Close-up of special tooling on Potter and Johnston 4-D automatic chucking and turning machine used for recessing cut in radial aircraft engine reduction gear pinion.

(Below) Colonial Broach Co.'s pull down type of broaching machine which provides simplicity of loading and unloading, while at the same time eliminating both manual and automatic broach handling for internal broaching. The machine has a cutting speed of 30 f.p.m. on the down stroke, and a high speed return of 60 f.p.m. It is rated at four tons capacity.



WITH summer heat apparently having dried up the sources which normally flood this department with contributions (editorial), we finally have opportunity to plunder our fat dossier of reserve material. One of the papers which we've unfortunately had to delay reporting is concerned with the selection of motors for machine tools. It was presented this spring before the Westinghouse Machine Tool Electrification Forum by W. F. Ridgway, development engineer of the Ingersoll Milling Machine Co. In this paper Mr. Ridgway discusses a time-saving empirical method of selecting motors which has been worked out by the Ingersoll company. The method is based on the theory that once the function of the various characteristics of motors is clearly defined, selection can be made quickly without the necessity of "reaching into a rarified atmosphere for the answer." The author covers his subject thoroughly and we can do no more here than attempt to skim the cream.

Provided the sole customer restriction is that of

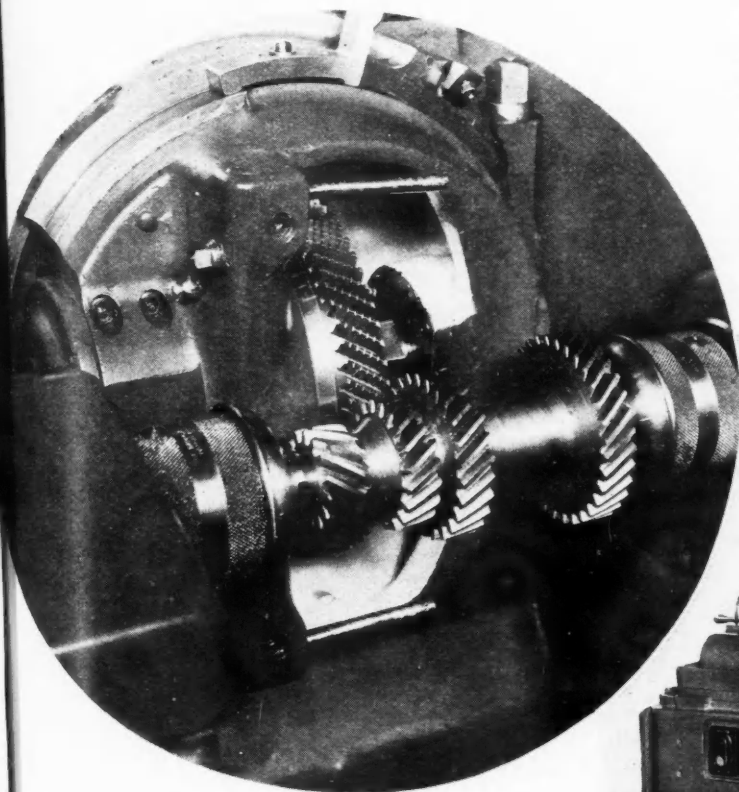
Some Interesting Ideas on How to Save Time Motors for Machine Tools

power supply available, the first step in the procedure leading to final selection is to choose the type of enclosure inasmuch as it will affect the power rating and the mechanical modifications. There are the following enclosures to be considered: open; semi-enclosed; drip proof; drip-proof—fully protected; splash proof;

totally enclosed—non-ventilated; totally enclosed—fan cooled; and totally enclosed—blower ventilated. Limitations of each of the aforementioned types of construction are discussed in detail in the paper.

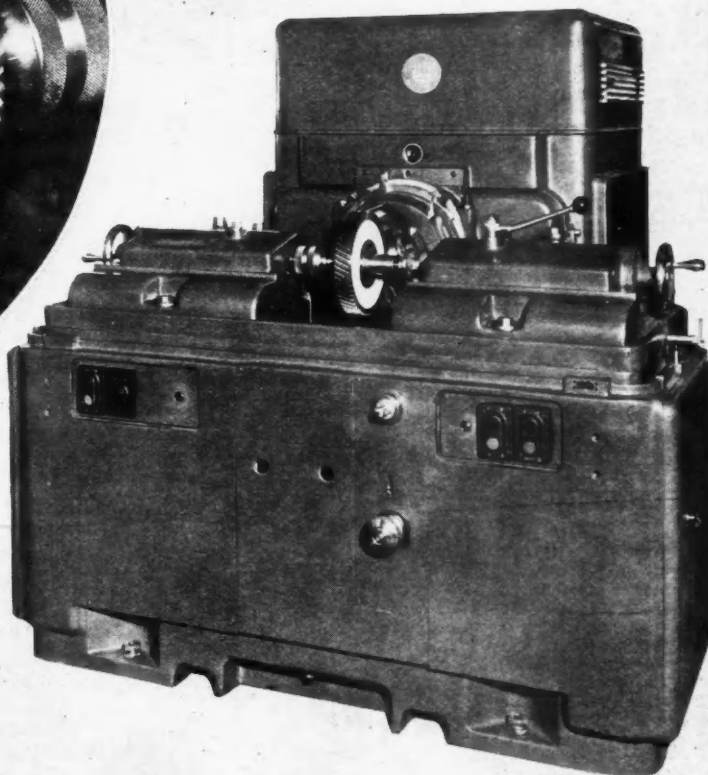
When decision as to the most desirable type of enclosure has been made the next step is to determine the torque characteristics required. Those commonly used are normal, high, and low starting torque, and the high slip type for alternating current; also shunt, compound and series wound for direct current. There are, of course, special characteristics available for applications not covered by these types such as for rapid cushioned reversing, for exerting continuous stalled torque, etc. While the various torque characteristics are also discussed at length in the paper, we shall proceed directly to the description of selecting the horsepower rating.

(next page, please)



(Circle) Finishing a shoulder or cluster helical gear by the "parallel-axes" method on a Fellows Gear Shaper No. 18 machine.

(Right) Fellows Gear Shaper Co.'s new No. 18 machine for finishing external spur and helical gears by a process employing a rotary finishing tool.



NEW DEVELOPMENTS

It is pointed out that when the exact nature and magnitude of the load are unknown and not determined, "the power selection must be made on the basis of judgment with attention to the fact that only an open continuously rated motor with unrestricted ventilation can be expected to deliver up to 115 per cent of its rated capacity continuously and that the approximate maximum torques and horsepower of motors, deliverable momentarily," are as shown in Table 1.

Mr. Ridgway, continuing on from this point, states "When the exact nature and magnitude of the load are known, the selection can be made on a rational basis. After plotting the load curve which the motor will be expected to deliver, the horsepower can be calculated on a root-mean-square basis and a rating chosen which is the next higher standard rating above the figure for the root-mean-square horsepower. It should be noted that totally enclosed fan-cooled, and totally enclosed, non-ventilated motors, when selected on the root-mean-square basis, should not be expected to carry a 150 per cent load for more than 40 consecutive seconds.

"The choice of a motor on the

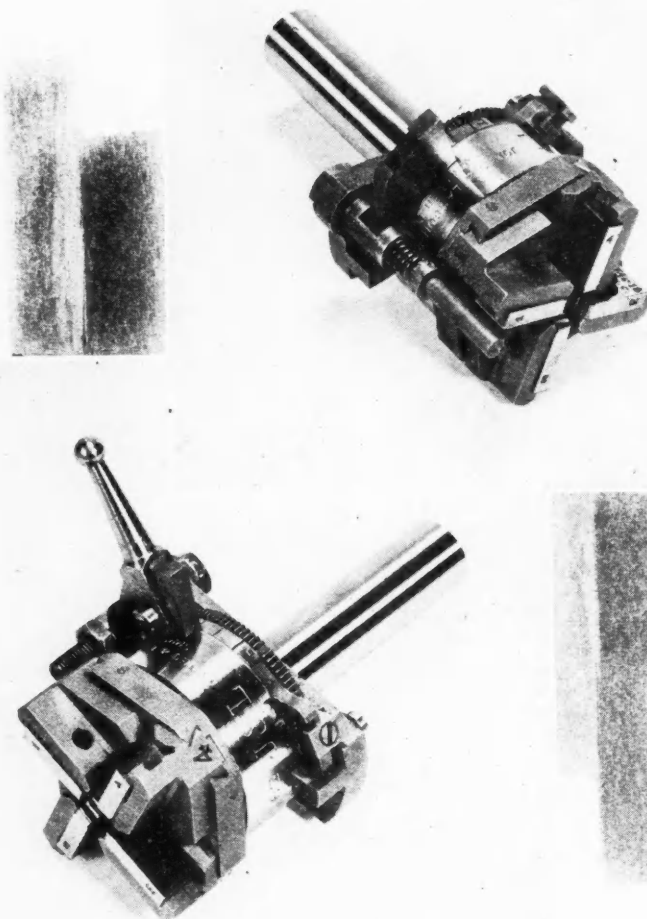
root-mean-square basis assures that the motor will not overheat. It is also necessary to consider the maximum horsepower which must be delivered for it is possible to have machining cycles with high peaks and broad valleys which would mean the selection of a motor on the root-mean-square basis which would not overheat, but neither would it have the capacity to deliver the power required at the peak; thus it is necessary to check the application of the motor on the basis of the

maximum horsepower. This can be done by using one of the factors in Table 2.

"When a repetitive machine cycle requires an alternating current motor with a total of more than four starts, plug stops, plug reversals, or speed changes per minute, the application should be checked with the motor manufacturer.

"This completes the application of the horsepower rating from which the time rating may be chosen. A continuous rating is required where the ratio of the root-mean-square horsepower to the actual horsepower rating selected is greater than 0.70.

"If the ratio of root-mean-square horsepower to the actual rating selected is less than (Turn to page 187, please)



Two new die heads developed by the Jones & Lamson Machine Co. The die shown at top right is designated as model 16SB and is recommended for use on No. 0 and No. 00 Brown & Sharpe automatics. The model 16S die head, lower left, has an external trip and is for use on small hand screw machines.

Table 1	Per Cent Maximum Torque	Per Cent Hp.
AC, normal starting torque, normal starting current	250	180
AC, normal starting torque, low starting current	230	165
AC, low starting torque	190	150
AC, high starting torque	240	130
AC, high slip	260	115
DC, constant speed, shunt wound ..	200	200
DC, shunt, adjustable speed, above twice base speed	150	130
DC, compound wound	300	200

Table 2	Over 900 RPM	900 or less
AC, normal starting torque, normal starting current	0.66	0.72
normal starting torque, low starting current	0.72	0.78
high starting torque	0.91	1.00
low starting torque	0.79	0.86
high slip	1.00	1.00
DC, constant speed, shunt or comp'd	0.60	0.60
DC, adjustable speed	0.75	0.75

NEWS OF THE INDUSTRY

Dealer Mortality Survey by NADA

Failure Percentage Near Two-Thirds

According to a survey by the National Automobile Dealers Association nearly two-thirds of the automobile dealers who operated in 61 communities of the United States have gone out of business during the past 10 years. The 61 communities canvassed were important centers in 24 states scattered throughout the country.

The figures in the survey covered both the number of dealers who were in business in 1929 and those who started during the 10 years prior to June, 1939. Out of 1254 dealers who started business 10 years ago, 806, or 64.3 per cent, are no longer in business. Since then 847 dealers opened a place of business in these 61 communities and likewise closed up. Altogether, 2101 dealers attempted to operate and only 976 stayed in business, or 46.4 per cent.

"If the experience shown in this survey represents average conditions," commented Walter E. Blanchard, manager of N.A.D.A., "then it is to be expected that two out of every three dealers in business today will fold during the next decade. Automobile dealers could well afford to study ways and means of reducing this mortality rate through the elimination of unsound business practices which are large responsible for dealer failures."

The survey also included the estimated capital losses by the dealers who were liquidated. Although definite information was missing in some cases, an amount of \$19,429,245 was arrived at by drawing an average of dealer capital losses in the instances where information was available. This computation showed an average loss for 1125 dealers during the past 10 years of \$17,240.44 per dealer.

Arthur P. Aller

Arthur P. Aller, vice-president of the Janesville Products Co., manufacturers of spark plugs and other automotive equipment, until his retirement three years ago, died unexpectedly at his home in Janesville, July 31. He had been ill since mid-July when he suffered a heart attack, but was thought to have been recovering when fatally stricken. He came to Janesville in 1909 and joined with Roy E. Wisner in the Wisconsin Carriage Co., which later became the Janesville Products Co.



Acme

Talk-Over

Henry Ford (left) and Harry Ferguson apparently have no fear that the recently introduced Ford-Ferguson tractor will fail to prove a success in the tractor field—if their facial expressions are any indication of their feelings as they chatted together recently. On the table between them stands a model of the recent entry to the low-priced tractor field.

World Registrations at 43,819,929 Continue Advance for Sixth Year

Department of Commerce Report Shows Diesels Have Gained Most in Year

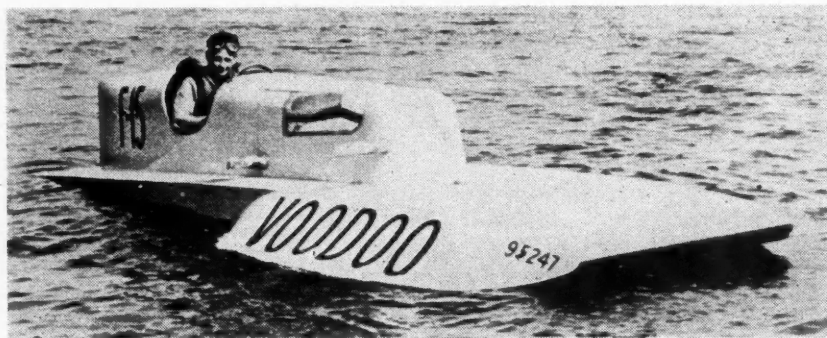
The annual registrations of passenger cars, trucks and buses throughout the world, as reported by the Department of Commerce, advanced for the sixth consecutive year to the all-time record total of 43,819,929 vehicles in operation as of Jan. 1, 1939. This represented an increase of 741,299 units or 1.7 per cent as compared with the previous year's figure.

The attainment of this record total is attributed by the Department of Commerce report to an advance of 7.1 per cent in the motorization of countries outside of the United States, since registrations in this country declined slightly from the total recorded on January 1, 1938.

Compared with Jan. 1, 1929, the world registration of motor vehicles, excluding motorcycles, has shown an improvement of 36.8 per cent; the United States, 21.2 per cent, while the world total, excluding the United States, has advanced by 88.7 per cent, the report indicated.

In the year under review motor vehicle operation in the United States included 25,264,260 passenger cars, 4,427,413 trucks, 156,237 buses, and an estimated 5,000 Diesel units. This compares with 25,449,397 cars, 4,450,507 trucks, including Diesel powered vehicles, and 141,488 buses on January 1, 1938. It will be noted that the number of buses in use registered the only increase during the year. In those countries outside of the United States, the 1938 figures were 9,428,802 passenger cars, 3,198,023 trucks, 323,940 buses, and 86,573 Diesel units, as against the current totals of 10,160,666 passenger cars, 3,409,263 trucks, 267,039 buses, and 130,051 Diesels. Of these vehicles only buses showed a lower total than was recorded a year ago, passenger cars being up by 13 per cent, trucks by 6 per cent, and Diesel units by 50 per cent.

Generally speaking, the report said, the reaction to American automotive (Turn to page 186, please)



Acme

Combination

Chauncey Hamlin, Jr., Buffalo, N. Y., sportsman, shown in his new type speedboat. The craft has pontoons and an airplane-type cockpit. Sixteen feet long, it is powered by a 175 h.p. Lycoming engine. It draws only two inches of water when under way.

Colorado Threatens Manufacturers With Dealer "Chain Store" Tax

State Treasurer Attempting to Collect License Fees from Seven Car Builders

Based on a ruling by the State Supreme Court of Colorado, which held that Gamble-Skogmo, Inc., an automobile accessories concern with retail stores in the state operating under the name "Gamble Stores," was liable under the Colorado Chain Store Tax Law for multiple store license fees for individually owned stores operating under the name "Gamble Stores Agency," the State Treasurer has rendered tax bills to General Motors, Chrysler, Ford, Hudson, Packard, Nash and Studebaker for multiple store license fees covering their respective dealers operating within the state for the past five years.

The court ruling states that "on the one side there is an intimacy of regulation, and on the other a fullness of submission which imports ultimate control in the company (Gamble-Skogmo, Inc.)" and concludes with "the operation of the agency stores was ultimately controlled and directed by the company within the meaning of section 7 of the chain store law. . . ."

Section 7 of the law reads—"The provisions of this Act shall be construed to apply to every person, firm, corporation, association or co-partnership, either domestic or foreign, which is controlled or held with others by majority stock ownership or ultimately controlled or directed by one management or association of ultimate management."

Evidently based upon the interpretation of the law, as applied by the Supreme Court in the case of Gamble-Skogmo, Inc., and the claim that since automobile manufacturers exercise a certain amount of control over dealers, the manufacturers are subject to the tax, the State Treasurer is attempting

to collect the multiple store license fee from the car manufacturers to cover their dealers. The law was passed in 1935, and if the claim is upheld by the courts, car manufacturers would be liable for the tax not only for this year but for each year from 1935.

Just what the car manufacturers are going to do about it remains to be seen. A meeting was scheduled to be held in Detroit early this month, to be attended by legal representatives of the Automobile Manufacturers Association, Ford Motor Co., and possibly of N.A.D.A., to decide what action will be taken.

It is understood that the Colorado authorities are studying the Gamble-Skogmo, Inc., decision, and may decide to render tax bills to the remaining car manufacturers as well as truck and tractor manufacturers, and may also apply it to all oil companies operating filling stations in the state.

Packard First to Preview '40 Models

With the greatest volume of advance orders from dealers in the history of the company, according to M. M. Gilman, president, and with announcement of new lower prices on all models, Packard Motor Car Co. on Aug. 8 gave a preview of its 1940 cars to more than 3500 distributors, dealers, salesmen and newspaper men.

Prices on the new models, as indicated at the preview, were as follows for the lowest price model in each bracket: \$877.85 for the one-ten 122 in. wheelbase business coupe; \$1,048.85 for the one-twenty 127 in. wheelbase business coupe; \$1,524 for the one-sixty

super-eight 127 in. wheelbase business coupe; \$2,228 for the one-eighty custom super-eight 127 in. wheelbase four-door club sedan. All prices are delivered at Detroit, local taxes extra.

First in the field with 1940 models, Packard also announced that the new cars will be supported by the largest newspaper advertising campaign the company has ever placed.

"Production is already in full swing to fill dealer stocks that are practically exhausted," said Mr. Gilman. "There are less than 1000 of the 1939 models in the hands of dealers and the plant is operating on two shifts a day for the first time in a year and a half, to meet current customer demand. Dealers throughout the country are reporting an exceptionally large volume of advance orders. At the same time, used car stocks in the hands of dealers are the lowest in Packard history.

"The recently completed four year plan of plant expansion and reorganization has resulted in economies which make possible substantial price reductions. The reductions, as compared with prices a year ago, total \$120 on the lowest priced line, the one-ten, \$150 on the one-twenty and as much as \$400 on the super-8 using the touring sedan as a basis of comparison."

Mr. Gilman expressed confidence in the outlook for big automotive production the remainder of this year.

NSPA Index Reveals Rise

The index of monthly sales prepared by the National Standard Parts Association indicates that automotive sales in June reached a new high for the year, increasing 7 per cent above May and 23 per cent above June of last year. Sales for the first six months were 23 per cent above the same period in 1938.

Replacement parts shipped to wholesalers in June showed a 22 per cent increase over last June and the monthly average for six months was 22 per cent ahead of the first six months of 1938.

Original equipment shipped to vehicle manufacturers in June was 22 per cent above last June and the first six months' shipments were 52 per cent above last year. Export shipments for the first six months were 14 per cent above last year, same period.

Continental Takes Financing Step

Continental Motors Corp. was reported early this month as having completed the first step in its financing plan, as a result of the purchase of 75,000 shares of the corporation's common stock by officers, directors and employees of the company and the underwriting of 50,000 additional shares of such common stock by Van Alstyne,

Noel & Co. together with the receipt of an additional loan of \$300,000 to Continental Motors from the Reconstruction Finance Corp. Van Alstyne, Noel & Co. also have an option to purchase 76,348 additional common shares.

The common stock financing already completed is the first to be undertaken by Continental since 1933. Together with the RFC loan it has provided the company with \$550,000 of new funds, one of the major purposes of which is to meet the expense of moving the Detroit operations of the company to Muskegon, Mich.

Hayes Completes Financing Plans

With the receipt from the Reconstruction Finance Corp. of \$450,000 on a ten-year first mortgage, final steps in the refinancing of Hayes Body Corp. have been completed. Previously, \$300,000 had been received from A. W. Porter & Co., Inc., underwriter, from the sales of capital stock.

From the proceeds of this financing a \$237,000 mortgage has been retired and the balance is to be used to strengthen working capital position, it is reported.

For a number of years the corporation has been handicapped by lack of working capital, according to E. J. Connolly, president. The financing just completed, he said, places the corporation for the first time in approximately ten years in a financial position to secure and handle profitably a substantially greater volume of business.

Rolls-Royce to Build Large Glasgow Plant

The early erection of an engine manufacturing plant for the Rolls-Royce Co. near Glasgow, Scotland, has been announced according to a report received by the Department of Commerce from the American Consulate in that city. The plant is expected to cost \$18,720,000 and will employ approximately 10,000 men.

40 YEARS AGO

Some makers of steel stampings for bicycles expect a demand for their process from manufacturers of motor vehicles, contending that stamped steel parts are as strong and cheap, or cheaper, than forgings. A careful examination of a number of motor carriages failed to reveal any number of parts that could be stamped with advantage. Possibly on the lightest machines stampings might be used instead of forgings, but the forging seems to be preferable in nearly all cases.

—From *The Horseless Age*, August, 1899.

Automotive Industries



Acme

Portable Landing System

The first completely portable instrument landing system, manufactured commercially, and ready for use on established airports or in emergency cases with military aircraft anywhere in the field. This is the Air-Track system, a development of the Washington Institute of Technology, Washington, D. C.

The truck contains a gasoline-engine-driven generator which supplies power for operation of transmitters in the trailer. These transmitters produce the glide path down which the plane flies to the ground, and the localizer that guides the plane along a straight line toward the point of landing. The motorcycle contains a marker beacon transmitter, and a generator to operate it. The marker beacon is a radio curtain sent up vertically along the path of the incoming plane. As the pilot flies through this curtain he receives a signal and knows that he is a definite distance from the point where his wheels will touch the ground.

Step-Up in Steel Finishing As Labor Situation Clears

Car Makers Reported "Covered" At Delivery Prices Set in May

With the labor situation at automotive plants, that because of strikes had held back specifications, less acute, rolling and finishing operations of steel mills could be moderately stepped up this week. The rate of ingot production, according to the American Iron & Steel Institute's estimate, has recovered to 60.1 per cent of capacity. Until body plants are ready to take in heavier tonnages of flat steel and 1940 model assemblies get under full headway, little change in the situation is looked for, and gains for the steel industry then are predicated on not too great a seasonal loss in demand from the construction and other industries. Conflicting reports with reference to the price situation continue. The head of an "independent" steel company affirmed this week that automobile manufacturers were covered for deliveries over the remainder of the year at the prices established in May, adding however, that should additional sheet and strip steel orders come out, such business would be booked at "standard" prices. Reports that some of the buyers at the prices chalked up in May had unsuccessfully sought to augment these reservations, lack confirmation. Steel companies are striving with might and main to make as good a showing as possible in volume of billings over the next six weeks and shipments during what remains of the third quarter of the year, will be speeded up. Whether or not a desire to clean up commitments at May prices as soon as possible so as to be free to take advantage of any upward change in the

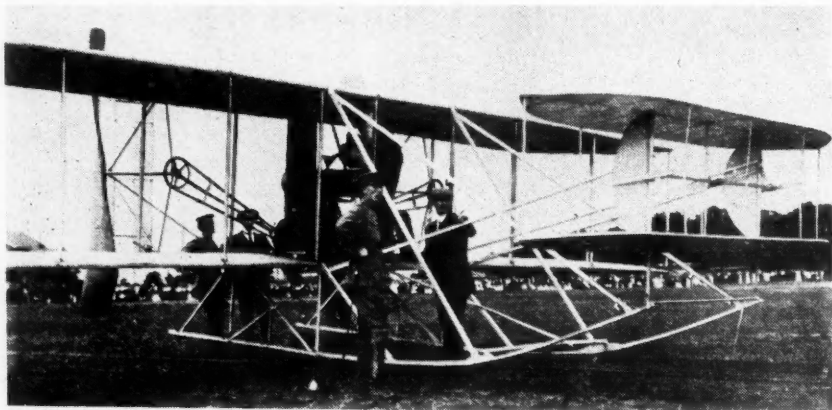
market has anything to do with this expediting of production and shipments, is a moot question, but certain it is that getting business as quickly as possible from order books onto sales-books is nothing more than normal routine. Flat steel production during the first six months of this year aggregated 3,936,251 tons, compared with 2,032,760 tons in the first six months of 1938. Decidedly better takings of steel bars, both hot and cold rolled, by automotive consumers are reported this week.

Prices of non-ferrous metals are steadily edging forward. Largely under the influence of buying for armament purposes, the London copper market scored one advance after another. Poland is reported to have bought heavily for emergency storage. South African copper producers have more business offered to them than they can accept because of cartel restrictions. The effect of the foreign situation on the market here has been to harden prices and to cause considerable covering. Copper and brass products have been marked up in conformity with the higher price of the basic metal.

Consumers are showing slightly more interest in tin offerings. Spot Straits tin was quoted early the week ending Aug. 12 at 48¼ cents. France is reported to have bought heavily, so as to be certain of ample reserves in the event of hostilities.

Further advances were scored by lead and zinc. Demand from brass manufacturers and die casting specialists for zinc has broadened.—W. C. H.

August 15, 1939



Acme

Anniversary

On Aug. 2 the U. S. Army commemorated the 30th anniversary of the purchase of the first military airplane from the Wright brothers in 1909. The top picture, taken in 1909, shows (left to right) Lieutenant B. D. Foulois, Wilbur Wright, Lieutenant F. B. Lahm and Orville Wright. Lahm is a Colonel now, still on active duty, and Foulois, Chief of the Air Corps, retired as a Major General. A part of the commemoration ceremonies included mass flights of modern planes at many points in the country. Lower photo shows mechanics readying one of the Army bombers at Mitchell Field, L. I.

Tire Makers Boost Production as Buying Wave Continues High

Manufacturers Increase Shift Hours With Consumption at Eight-Year Peak

Continued heavy consumer tire buying, the heaviest since 1931, is causing tire manufacturers to step-up production tickets and increase shift hours. This is the exact reverse of the usual procedure for the industry, as manufacturers normally relax production in mid-year and do not step-up output until original equipment production on tires for new car models gets under way in the fall.

While manufacturers' deliveries to the replacement market for the first half of 1939 were 33 per cent greater than for the same period of 1938, and in excess of 6,500,000 casings, consumer buying was even heavier as indicated by the shrinkage in dealer stocks from April 1 to July 1. The Commerce Department's July 1 tire stock census indicates that stocks of independent

dealers declined from 3,018,000 casings on April 1 to 2,900,000 casings on July 1, despite the record breaking dealer ordering during the period. Oil company retail stocks shrank from 1,725,000 units to 1,646,000 units.

The only increase in the retail stock picture was by manufacturers in their more than 2150 retail stores. These stocks plus stocks of chain stores rose from 2,074,000 on April 1 to 2,318,000 on July 1. The increase in manufacturer owned store stocks indicates the extent to which manufacturers stocked for their pre-July Fourth sale during which they offered special prices. The repercussions of these sales are still echoing in the industry. Manufacturers have agreed, through the Rubber Manufacturers Association to refrain from similar misleading advertising in the

future (AUTOMOTIVE INDUSTRIES issue of Aug. 1, page 132). The National Association of Independent Tire Dealers has protested the sale vigorously, and in some cities manufacturers are under grand jury indictment for alleged false and misleading advertising. Three independent manufacturers and four chain and mail order house systems are under indictment at Columbus, Ohio, for alleged fraudulent advertising. In several cities it is reported that managers of tire company owned retail stores were arrested on Better Business Bureau complaint.

The Government July 1 tire stock census report included more than 20,000 stations of 37 oil companies, 2150 stores of six tire manufacturers and 1687 stores of mass distributors.

Hudson Offers Three New Lines for 1940

Three new lines of 1940 Hudson cars, were privately previewed on Aug. 9 at Detroit. The press representatives were shown a new entry in the lowest price field—the new Hudson Six. Also spotlighted for 1940 is a new type of low-priced straight eight, companion car to which will be the new Hudson Super-Six, identical in all features except powerplant.

For the first time in the lowest price field independent front wheel suspension with center point steering is introduced, and Hudson's recently patented Auto-Poise Control will be found throughout the entire 1940 line. New comfort is added by longer rear springing and further refinement in Airfoam cushioning.

Safety developments continue in the 1940 models. Brakes have been further improved by a redesign of the mechanical reserve brake linkage. Added for 1940 are new directional safety signals, increased front and rear vision, a new heavier Armored X-type frame for the new suspension, and a further improved design of Hudson's Dash-Locking Safety Hood which hinges at the front to prevent being blown open by the wind and locks at the dash to prevent theft of car or engine parts.

All the new Hudsons have been restyled and the new characteristic front-end design has been maintained throughout the entire line. Longer, lower lines characterize all models, which are offered with or without running boards. The entire hood is of one-piece construction presenting a smooth, graceful frontal appearance unmarred by seams or openings.

Front grilles on all models are die-cast. The narrow vertical center section of the front-end design is of body color and is highlighted by a vertical chromium band which rises to form the name plate and hood ornament and then extends along the top of the hood to the new increased-vision windshield. Headlamps are entirely new and in all models are mounted flush in the fenders with ornamental chrome settings.

GM Tool-Die Makers' Strike Reaches Settlement Aug. 5

Retrofitting Program Resumed After Loss of Four Weeks' Time and Wages

Labor developments continued to hold the spotlight in automotive centers during the first weeks in August with major attention focussed on settlement of the prolonged UAW-CIO tool and die makers' strike in General Motors plants and on special elections called by the National Labor Relations Board in Chrysler, Briggs Mfg. Co. and Motor Products Co. plants to determine whether the CIO or the AFL factions of the UAW will represent employees in collective bargaining.

The General Motors tool and die makers' strike was officially settled on Aug. 5 after members of the striking UAW-CIO locals had ratified the settlement made by their leaders with GM officials on Aug. 3 after negotiations had continued daily for almost four weeks. Review of the terms of the settlement left considerable question as to whether the strike had gained anything for the rank and file of the UAW faction involved, unless they gain some satisfaction from an apparent improvement in technical position in certain plants insofar as the rival AFL faction is concerned. Tangible losses were considerable delay to General Motors in its retrofitting program for 1940 models, on which work was actively resumed on August 7, and losses in wages best summarized in the following statement by W. S. Knudsen, GM president:

"As a result of the strike about 100,000 people will have lost four weeks time, or at least 14 millions of dollars in wages. The strike itself has been marked by violence in Detroit, Pontiac and Cleveland, a condition for which the corporation has no responsibility. Over 100 employees have been hurt while going to and from work by bands of pickets. Hundreds of others who wanted to work were deterred by threats and intimidation by imported pickets, at the plants and at their homes. The corporation hired no extra guards to combat the strike but relied exclusively upon local and state authorities to preserve order. Statements to the effect that AFL interference was due to corporation influence are false.

"Unfortunately the corporation, its employees and the public have been the victims of a factional labor strife. Naturally we are happy to see the strike settled and all men back at work. Renewed assurances have been given that this is the last strike that will be called without exhausting grievance procedure in the original UAW agreement. We hope it will be so."

In reviewing the terms of settlement Knudsen's statement indicated that no

general wage increase has been granted in any classification as against the original union demand for a 10 cents an hour flat over-all increase. Certain adjustments in wages will be negotiated where scales are out of line as between certain plants. Assurances to this effect were given before the strike was called. Demand for union labels on tools made in GM shops were withdrawn, and the apprentice claim was set aside pending working out of a plan to be compared with present arrangements. Double overtime pay for work on Sundays and six specified holidays versus time and one-half as now paid, was granted. The union's original demand for a supplemental agreement covering tool and die makers was abandoned early after negotiations started.

The settlement was hailed as "a splendid victory" by leaders of the CIO faction while AFL leaders labeled it "a typical John L. Lewis sellout." It was believed, however, in informed

(Turn to page 181, please)

Old Timers

On Aug. 3, Flint, Mich., opened its second annual Motor Festival. Hosts at an "old timers" reunion, a part of the opening ceremonies, were C. S. Mott, director of General Motors Corp. and a pioneer in the motor car industry, and W. S. Ballenger, pioneer of the buggy manufacturing industry and one of the five men who helped finance the Buick Motor Co., first of Flint's large automobile concerns.

Speakers at the reunion included W. S. Knudsen, president of General Motors; C. W. Nash, chairman of the board of Nash-Kelvinator Corp., who began as a bench hand in the old Durant-Dort carriage factory and later became head of the Buick company; W. C. Durant, one of the founders of the Durant-Dort Co. and later organizer of the Chevrolet, Buick and Durant companies in Flint; J. D. Mansfield, pioneer of the motor industry and now president of Chrysler Motors, Ltd., of Canada; M. E. Coyle, president of the Chevrolet division of General Motors; H. H. Curtice, president of the Buick Motor Co.

Six-Month Automotive Exports and Imports

	JUNE 1939		JUNE 1938		SIX MONTHS ENDED JUNE			
					1939		1938	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
		\$		\$		\$		\$
Automobiles, parts and accessories.....		20,386,503		17,201,528		144,255,904		155,589,382
PASSENGER CARS								
Passenger cars and chassis.....	10,391	6,390,286	9,454	6,131,076	89,716	55,185,799	92,450	57,995,955
Low price range \$850 inclusive.....	9,368	5,293,615	8,062	4,586,486	79,897	44,825,507	80,480	44,943,353
Medium price range over \$850 to \$1,200.....	860	817,317	1,051	1,012,146	8,456	8,068,825	10,108	9,961,566
\$1,200 to \$2,000.....	135	195,349	293	399,730	1,129	1,675,729	1,508	2,195,459
Over \$2,000.....	28	84,005	48	132,704	234	615,738	356	895,577
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total).....	10,976	6,573,325	7,012	4,512,442	64,585	39,724,951	67,894	43,000,927
Under one ton.....	1,593	650,608	1,483	648,945	9,768	4,121,158	10,119	4,306,841
One and up to 1½ tons.....	7,642	4,237,744	4,556	2,569,179	44,827	24,430,415	46,316	25,226,326
Over 1½ tons to 2½ tons.....	1,413	1,182,277	627	637,279	7,136	6,129,264	7,122	5,907,978
Over 2½ tons.....	244	439,295	321	634,727	2,396	4,652,518	3,362	6,862,053
Bus chassis.....	84	63,401	25	22,312	458	391,596	955	697,729
PARTS, ETC.								
Parts except engines and tires.....		2,505,197		2,468,097		21,401,244		27,477,816
Automobile unit assemblies.....		3,690,148		3,128,752		19,787,509		18,717,980
Automobile parts for replacement (n.e.s.).....		311,485		270,166		1,919,080		1,746,047
Other automobile accessories (n.e.s.).....		424,366		422,379		2,225,269		2,320,331
Automobile service appliances.....		6,524,289		4,449,068		30,612,371		21,005,848
Airplanes, seaplanes and other aircraft.....	150	10,619,563	93	2,866,529	733	48,868,615	435	12,620,354
Parts of airplanes, except engines and tires.....								
INTERNAL COMBUSTION ENGINES								
Stationary and Portable.....								
Diesel and semi-Diesel.....	50	204,100	32	90,969	240	972,392	267	1,281,032
Other stationary and portable.....								
Not over 10 hp.....	931	51,655	1,070	63,441	6,583	386,441	6,109	405,836
Over 10 hp.....	263	111,369	356	212,637	836	526,432	2,140	917,276
Engines for:								
Motor trucks and buses.....	1,591	212,933	1,366	155,880	13,937	1,686,127	15,678	1,737,576
Passenger cars.....	877	96,497	1,062	88,466	14,473	1,376,357	26,473	2,155,359
Aircraft.....	195	1,468,531	112	602,749	807	5,632,171	610	3,345,400
Accessories and parts (carburetors).....		573,253		7,952,932		3,289,017		37,121,659
IMPORTS								
Automobiles (durable).....	53	29,590	52	21,930	256	183,322	326	186,857

Japan Reported Building Special Cars for Export

New Manchurian Company Attempts To Monopolize Foreign Car Imports

Not many of the 30,000 cars that rolled off the assembly lines of Japanese motor plants last year are doing service in Japan. Trucks and cars were, and still are, shipped off to the continent for war duty almost as soon as the olive-brown regulation paint has dried.

Others, sprayed in more civilian shades, and mostly of the "baby-car" variety, are sent to Shanghai, where they are competing with Italy's Fiats, Germany's Opels, Britain's Austins and China's man-pulled rickshaws.

Nissan and Toyota have spread a net of assembly plants and service stations all over North and Central China, and at least one shop has been built at Canton, South China. Nissan is planning a big propaganda show at Shanghai to introduce its cars to foreign residents.

However, all this does not bring in any amount of badly needed foreign exchange. Efforts to export Japanese cars to the rich markets of South America, South Africa, Dutch India and Oceania have been made in the past, but met with failure owing to the lack of efficient sales and servicing organizations. Another drawback was the failure of Japan's most exportable car, Nissan's tiny Datsun, to meet the requirements of those markets, which call for a slightly roomier, yet economical, car.

Both Nissan and Toyota are experimenting with such cars, which they plan to produce in large numbers, with the entire output to be shipped abroad. According to one version, both are modeled closely on the pattern of the German "People's Car," which is powered with an air-cooled engine. Another report has it that they will be conventional water-cooled units, of 2,000 to 2,200 c.m. piston displacement.

Through the efforts of the Automobile Traders' Association, the long-mooted plan of organizing an Automobile Exporters Association seems to have been given fresh momentum, and application for recognition of the Association as a semi-official export organization has been filed with the proper authorities.

Japanese exports of automobiles for the first four months of this year comprised 792 units, valued at approximately \$700,000. Parts included chassis were valued \$1,650,000, tires \$400,000. The trade returns reveal a substantial increase in exports of parts other than complete chassis over the corresponding periods of 1938 and 1937. The figures were \$380,000 for the first four months of 1937, \$670,000 for 1938 and \$1,550,000 for this year.

In order to give parts exports an extra boost, it is now planned to exempt

ten or twenty items from business profits taxation.

Manchurian Import Monopoly

The Dowa Automobile Co., of Manchuria, which in the past carried on a none-too-successful job assembling Japanese chassis for the Manchurian market, has been squeezed out of business by the establishment of a semi-official automobile manufacturing corporation with a capital of 100 million yen.

With official support, Dowa is now attempting to monopolize the importation of such foreign cars as are still required until the projected manufacturing plant gets going. The company has already bought out several foreign import organizations. Its first big business was the recent importation of 5000 Ford cars and trucks, including the first Ford Diesels ever to be shipped to Manchuria. It appears, however, that GM is still reluctant to have its Chevrolet agency run by the Manchurian firm.

Mr. Soji Yamamoto, a director of the newly established motor corporation and concurrently president of the Nissan Automobile Co., of Japan, left Japan on July 6 on the *Tatsuta Maru* for the United States, where presumably he will make a fresh attempt at getting American motor capital interested in credits for Manchuria.

Bosch Patent Syndicate

Jointly financed by eight leading Diesel manufacturers in Japan, the Nippon Diesel Machinery Co., Ltd., a 6,000,000 yen concern, has been organized to exploit the German Bosch patents for fuel injection equipment.

Parties to the syndicate are Mitsubishi Heavy Industries, Tokyo Automobile, Ikegai Automobile, Kobe Steel Works, Niigata Iron Works, Osaka Iron Works, Kubota Iron Works and Okayama Motors.

Of the 120,000 shares to be issued by the company, Mitsubishi and Tokyo Automobile each will subscribe 30,000,

while the balance will be allotted to the remaining six makers.

This is the second time in recent years that an important foreign patent has been jointly acquired by all Japanese makers interested in its exploitation. The precedent was set in the fall of 1937, when a syndicate of Japanese iron works and steel mills bought the Krupp-Renn iron concentrating process from Germany at a price of 10,000,000 yen.

MEN

The Rust Master Chemical Corp. has recently named as sales manager S. K. Dennis, formerly sales manager of the Thermoid Co. In his new position, he will be in charge of sales, advertising, and merchandising for the complete line of Rust Master products.

Robert B. Davis has been named general manager of the Raybestos division of Raybestos-Manhattan, Inc., to succeed the late Morton F. Judd.

R. C. Allan, formerly sales manager of the Stromberg Carburetor department of Bendix Aviation Corp., has been made sales manager of the Zenith Carburetor division. Announcement has also been made of the appointment of G. C. Fricke as plant manager of the Zenith Carburetor division, filling the vacancy caused by the resignation of V. W. Heftler, for a number of years president of Zenith.

D. J. Hutchins, formerly assistant sales manager in charge of truck and by-product sales of the Ford Motor Co., has been appointed to the Firestone manufacturers' sales staff in Detroit.

M. H. Avram has been made director of the recently organized engineering department of Designers for Industry, Inc. He recently returned from abroad upon completion of railroad construction projects for the Turkish government.

W. H. Dunn, comptroller and assistant treasurer of Raybestos-Manhattan, Inc., was elected secretary of the corporation at a recent meeting of the board of directors. He succeeds the late M. F. Judd.

Truck Production by Capacities

(U. S. and Canada)

	Six Months		Per Cent Change	Per Cent of Total	
	1939	1938		1939	1938
1½ tons and less	367,468	272,678	+ 34.9	91.95	93.10
2 to 3 tons	18,097	10,596	+ 70.0	4.53	3.62
3½ tons and over	6,597	4,688	+ 40.8	1.65	1.60
Special and buses	7,459	4,920	+ 51.8	1.87	1.68
Total	399,621	292,882	+ 36.1	100.00	100.00

F. M. Gillies has been appointed general superintendent of the Indiana Harbor Works of Inland Steel Co. He succeeds H. R. deHoll, whose retirement has recently been announced.

C. W. Bishop of Detroit has been appointed general counsel of the National Automobile Dealers Association. The N.A.D.A. also announces the appointment of S. Clutterbuck to have charge of the association's used car guide book and membership sales.

N. A. Woodworth, formerly president of the Ex-Cell-O Corp., has announced the formation of his own organization, the N. A. Woodworth Co. Associated with him in the new venture are E. W. LaMonte, formerly with the Swartz Tool Products Co., and J. F. Benner, formerly with the Partool Machine Co. The new company has acquired the facilities and plant of the Partool Machine Co.; activities will be directed toward precision tool and machine work as well as machine tool work.

G. Yoquelet, formerly with the Auburn Automobile Co. and more recently branch manager for Firestone, has been elected treasurer of the Auburn Rubber Corp.

S. J. Case has been made merchandising manager of the DeSoto division of Chrysler Corp.

Ditzler Color Co. announces the appointment of W. M. Fegen as assistant director of the division of creative design and color. Mr. Fegen was for 15 years director of color and styling for the Pierce Arrow Motor Car Co.

E. L. Lick, identified with the Chrysler Corp. and its various subsidiaries for the past ten years, has been made special representative of the sales department of Willys-Overland Motors, Inc.

F. A. Wright has been appointed manager of resale sales of Cutler-Hammer, Inc. In his new capacity, Mr. Wright will occupy the position formerly held by B. M. Horter who was recently appointed general sales manager.

C. Reese has been elected president of the Continental Motors Corp. He succeeds W. R. Angell, who has resigned as president, treasurer and a director, but who has accepted the post of technical adviser to the corporation.

All officers of Oshkosh Motor Truck, Inc., Oshkosh, Wis., were re-elected by directors following their re-election to the board by stockholders at the annual meeting recently. Directors renamed were George Hilton, O. J. Hardy, C. W. Hoyt, C. A. Wiechering and L. A. Gunz. Officers are Mr. Hardy, president; Mr. Wiechering, vice-president; F. S. Losse, New London, Wis., secretary, and W. G. Macy, treasurer and general manager.



Celebrate

William S. Knudsen (left) and Alfred P. Sloan, Jr. (right) were greeted by F. G. Hughes, general manager of the New Departure division of General Motors Corp., when they arrived at Meriden, Conn., for a trip through the New Departure plant and an "old timers" party to celebrate new Departure's 50th anniversary.

Labor

(Continued from page 179)

circles that the settlement had given the CIO faction certain tactical advantages over the AFL, leaders of which are now conducting a widespread organizational drive in support of their branch of the UAW.

Meanwhile considerable attention is being paid to the largest collective bargaining election ever to be held under NLRB auspices called by the board on Aug. 1 in the plants of the three companies previously mentioned. In calling the elections the NLRB ordered that Chrysler employees should ballot within 20 days, Briggs employees in 20 days, and Motor Products employees in 15 days from Aug. 1. Except in a few special instances employees in each plant will vote to determine which faction of the UAW will represent them in collective bargaining so that it is likely that some plants will be represented by the CIO and others by the AFL. Calling of the elections followed petitions by the companies and the CIO while the AFL had opposed them. However, the CIO had demanded elections on a corporation-wide rather than plant basis while AFL had urged for plant elections, if held.

Decision of the NLRB to hold the elections and instructions to its Detroit offices to investigate the factional situation in General Motors plants, following a petition from GM for similar elections, is expected in many quarters to result in elections in GM plants also, although as this was written no deci-

sion had yet been made by the NLRB. Hopes were also high that an election would be called to settle a factional dispute at Packard where the CIO faction has threatened a strike.

Filing of petitions by the UAW-AFL with the NLRB asking for employee elections in every General Motors plant in the U. S. is looked upon as removing the last obstacle to balloting which will determine the wishes of GM workers as to union representation. The UAW-AFL also had been considering injunctions opposing the NLRB elections in Chrysler, Briggs and Packard plants but its latest decision to support the elections is believed to have removed any possible obstructions there also.

Frank H. Bowen, Detroit Regional Director for the NLRB, has fixed Aug. 15 as the date for voting by Motor Products employees and Aug. 17 for Packard employees. Dates for Chrysler and Briggs votes have not yet been set because of the enormity of preparations involved. In all elections, it was indicated, employees would have an opportunity to indicate whether they wanted to be represented by the UAW-CIO, the UAW-AFL, or by neither union.

"Single Plan" Desired On Reo Loan Request

Application for a loan of \$2,000,000 from the Reconstruction Finance Corp. to provide working capital for the Reo Motor Car Co. has not yet been acted upon favorably because of differences in operating plans presented to the RFC by attorneys representing the trustee and a majority stockholders' group, it was announced in U. S. District Court in Detroit on July 31 at a continued hearing on the company's application for reorganization under Section 77-B of the National Bankruptcy Act.

At the hearing the court was advised by Byron Ballard, attorney for the trustee, Theodore I. Fry, that after the trustee's application for a loan had been made the RFC was presented with a plan of operations that differed from that of the trustee by counsel for the majority of stockholders' group. Both sides, the court was told, were advised by the RFC to eliminate differences and present a single plan before requesting further action on the loan application. As a result the court adjourned the reorganization hearing with instructions to Ballard to act as spokesman in further negotiations with the RFC. The loan represents an integral part of the reorganization plan on which the court has been holding hearings.

The hearing was postponed until Aug. 14, at which time the court was scheduled to listen to a motion filed by counsel for the majority stockholders asking that reorganization proceedings be discontinued as they have prejudiced and interfered with the improvement of the financial condition and progress of the company.

Private Carrier Drivers May Be Limited to 60 Hours per Week

ICC Examiner Recommends Rules Governing Safety of Operations

More than 600,000 trucks operated by private carriers will be subjected to Interstate Commerce Commission rules governing safety of operation and drivers will be limited to a maximum of 60 hours of work each week if the Commission approves recommendations made by Examiner R. W. Snow, of the ICC's Division of Motor Carriers. He suggested that certain exceptions be made for farm and work trucks.

After the ICC conducted hearings in 11 scattered cities, beginning in Washington and ending in Atlanta, Ga., on May 2, the examiner concluded after weighing all the evidence that since the number of vehicles operating by private carriers in interstate and foreign commerce exceed the number operated by common and contract carriers and that since the vehicles in the former category are as great a potential hazard to safety as those in the latter classification, they should be subjected to the same regulations.

The report recognized that while some inconveniences will be occasioned and that perhaps earnings of companies employing driver salesmen will be reduced, it reasoned that these considerations seem "unimportant compared to the question of highway safety." There is no justification from the testimony submitted in this record for permitting longer hours on duty for a driver of a motor vehicle than 60 hours per week, the examiner said.

In December, 1936, the ICC prescribed regulations governing the qualifications of drivers, safety of operation and standards of equipment applicable to common and contract carriers and in July, 1938, it fixed maximum hours of service for drivers of such vehicles. The first order became effective in July, 1937; the second in October, 1938, for bus drivers and in March, 1939, for operators of all other common and contract carriers. In October, 1938, the ICC instituted proceedings to determine reasonable requirements to promote safety of operation for private carriers. The ICC is authorized to do this under provisions of the Motor Carrier Act but only "if need therefore be found."

A motion to dismiss the proceedings was filed by the National Council of Private Motor Truck Owners which argued that (1) the Commission is not authorized to establish rules for private carriers but merely to investigate the subject and report to Congress; and (2) that if after proper construction the law is interpreted as authorizing the Commission to proceed, the Act is unconstitutional.

To the first argument, Examiner Snow referred to testimony by Senator Wheeler, chairman of the Senate Inter-

state Commerce Committee, during the course of hearings on the motor carrier bill. The testimony indicated that the Senator understood the bill to empower the ICC to go ahead and prescribe standards and maximum hours of service for private carriers. The examiner also pointed to a provision in the Fair Labor Standard Act, under which certain employees not coming under ICC jurisdiction are exempted from the wage-hour law, as an indication of Congressional recognition of the Wheeler contention. The report called the unconstitutional claim "not a proper one" on which to base a motion to dismiss as the duty of the ICC is "to administer the law" and "not to pass upon the constitutionality of an Act of Congress."

Under his "findings of fact," Examiner Snow pointed out that 28 states do not in any way regulate or limit the hours of service of drivers working for private carriers and that many states do not require privately operated trucks to be equipped in a manner necessary for the safe operation of such vehicles; that it is dangerous to permit individuals not in good physical condition to operate trucks; and that based upon these specific findings, there is need for Federal regulation of private carriers.

Taking the view that vehicles operated by farmers are operated under conditions substantially different from those under which private carriers operate, Mr. Snow recommended these exceptions: (1) that drivers be at least 18 years of age; (2) that they need not be subjected to a physical examination; (3) that passengers be not prohibited from riding on such farm trucks except under certain conditions; and (4) that drivers be limited to 50 hours a week. Rules which would ordinarily govern drivers of work trucks would be relayed under the recommendations so that drivers would be freed from the necessity of keeping a driver's log.

Interested parties have been given until Sept. 29 to file exceptions to the recommendations.

Bendix Acquires Linderman License

Bendix Aviation Corp. has acquired a license from Linderman Devices, Inc., in connection with the production and sale of a new aircraft brake already adopted as standard equipment by some aircraft manufacturers.

The basic element of the aircraft brake is an early Linderman design consisting of circumferential expander tube which applies equal pressure at all points between the lining and the drum,

equalizing wear and eliminating self-energizing action.

Other licenses granted by Linderman Devices include:

Timken-Detroit Axle Co. for the exclusive manufacture of fluid and air operated brakes for commercial and military vehicles and

Westinghouse Air Brake Co. for exclusive sales rights on air-operated Linderman brakes for commercial vehicles.

Packard Motor Car Co. also has a non-exclusive license for the production of Linderman brakes for passenger cars of its own manufacture.

Aeronautic Exports For June Set Record

The total value of aeronautic exports in June, 1939, as reported by the Department of Commerce was \$10,619,563. This is a record month for aeronautic exports. The previous record month was May, 1939, whose total value was \$10,385,335. The June total is 2.2 per cent above that for May; it is 31.63 per cent over the total for June, 1938.

The large volume of exports in May and June together with growing totals in earlier months brought the total for the first half of 1939 to \$48,866,612. This total is 31.63 per cent larger than the total for the first half of 1938 and is almost three times that of \$16,290,580 for the first half of 1937. It is nearly 72 per cent of the total value for 1938 which was \$68,209,050 and about one-quarter larger than the 1937 total which was \$39,405,473.

General Motors Corp. Six Months' Profit

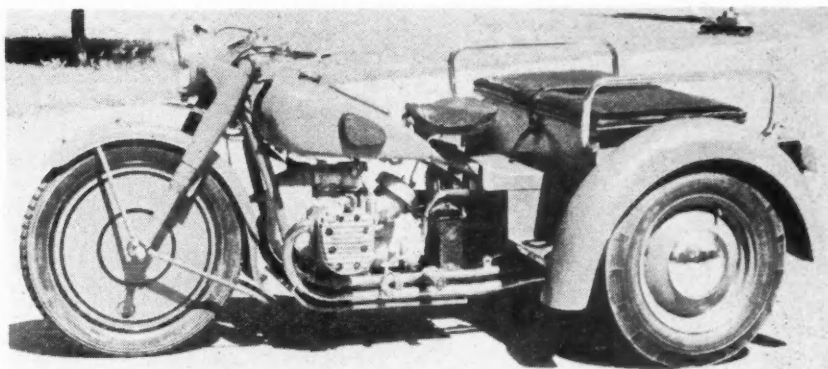
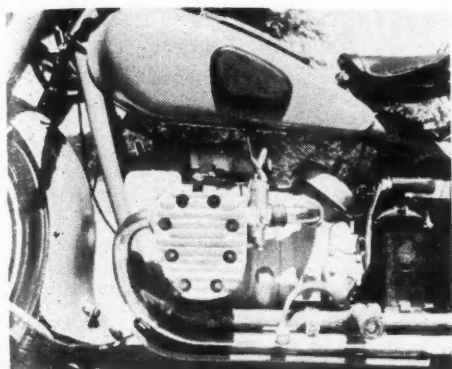
General Motors Corp. financial report to stockholders indicated net earnings of \$100,992,531 for the six months ended June 30. This was compared with net earnings of \$33,020,019 for the first six months of 1938. Second quarter profits of the corporation were reported as \$47,814,603; compared with \$24,786,002 for the second quarter 1938. Net working capital increased \$61,144,523 during the first six months of this year.

The directors of General Motors Corp. meeting on Aug. 7 declared a dividend of 75 cents per share on the outstanding common stock, payable Sept. 12 to stockholders of record Aug. 17.

The regular quarterly dividend of \$1.25 per share was declared on the five dollar preferred stock, payable Nov. 1 to stockholders of record Oct. 9.

Farm Equipment Exports Rise

Exports of farm equipment in June were valued at \$7,334,077, an increase of 4 per cent over the comparable figure for June, 1938, the Commerce Department's Machinery Division reports.



Globe Photo

New Development in Motorcycle Construction for Army Use

An interesting new development in American motorcycle construction is this tricycle produced by the Delco Appliance division of General Motors Corp. Overheating at low speeds and impairment of chain drives by mud and dirt have long been a bug-a-boo of the cycle in army use. This new machine has horizontally opposed cylinders with extended fairing for rapid cooling and employs a drive shaft instead of chains. Unit construction of engine and transmission is employed. The generator is mounted on top of the crankcase while an air cleaner is incorporated in the upper portion of the transmission case. Each cylinder has its individual carburetor and exhaust system. The engine is of 745 c.c. capacity, develops 22 BHP at 4600 r.p.m. The transmission has four speeds forward.

Larger harvesting machinery and tractor shipments accounted for most of the gain, while tillage implements and seed separators showed declines of 12 and 22 per cent, respectively.

Valued at \$4,387,011, exports of tractors, parts and accessories were seven per cent greater than a year ago when foreign shipments totaled \$4,104,863; wheel tractor exports were up three per cent to \$1,552,742 in June, 1939, and exports of tracklaying tractors were up four per cent to \$1,948,254.

June exports of tractor parts and accessories were valued at \$838,349 compared with \$714,069 in the same month as 1938 and exports of tillage implements totaled \$550,760, a 12 per cent decline below June of last year.

Valued at \$1,749,646, harvesting machinery shipments abroad in June were five per cent above the corresponding figure for the same month in 1938.

ADVERTISING

W. Ellzey Brown, new vice-president of Cleveland Tractor Co., will retain his affiliation with W. Ellzey Brown Associates, Chicago agency.

Spot radio, which accounted for about one third of all radio station income last year with a total of \$31 million, promises to show further gains for the current year. Of this 1938 volume, petroleum products accounted for \$2,647,560, and automotive accounts spent \$1,126,950, a recent survey made by *Advertising Age* shows.

Firestone Tire & Rubber Co. has named Abbott Kimball Co., New York, to handle its promotion of Airtex division which manufactures rubber upholstery products.

Pontiac Motor Division, General Motors Corp., has released a new slide-

film, "No Car on Earth is Better Engineered." Ninety engineering advances are featured in the film which will be shown to dealers.

Packard Motors Export Corp. has appointed National Export Advertising Service, New York, to direct its foreign promotion beginning with the 1940 models.

Ferguson-Sherman Mfg. Corp., Dearborn, Mich., maker of the new hydraulically-controlled farm implement control and distributor of the new Ford tractor which uses it, has appointed N. W. Ayer & Son, Philadelphia, to handle its advertising.

T. H. Corpe, a world-war ace, and formerly engineer on General Motors technical staff, an advertising executive for Fisher Body, and General Motors of Canada, has been appointed head of advertising and sales promotion of Lockheed Aircraft Corp, Burbank, Calif.

National Screw & Mfg. Co., Cleveland, is launching a special campaign in trade and technical papers in celebration of its 50th anniversary.

General Industries Corp., Newark, N. J., lubricant manufacturer, has appointed Hymen Levy Advertising Agency, Newark.

Lord & Thomas, advertising agency, and Albert D. Lasker, former president, were completely exonerated in connection with a \$250,000 loan disclosed in the conviction of former Federal Judge Martin T. Manton, New York, during disbarment proceedings against two attorneys. Federal Attorney John T. Cahill declared that in the opinion of the government Mr. Lasker "was grossly misused," and the prosecution found "absolutely no ground for criticism of Lord & Thomas."

Willys Meeting To Pass on Loan

A special meeting of preferred and common stockholders of Willys-Overland Motors, Inc., was called for Aug. 14, to pass upon the \$2,500,000 loan sought from the Reconstruction Finance Corp. All property of the company is to be pledged as security for the loan, said Joseph W. Frazer, president.

Proxies also were sought with a view to amendment of articles postponing exclusive control to preferred stock until default and six quarterly payments have elapsed after Aug. 15, 1944, maturity date of the loan, or until Willys Real Estate Realization Corp. is relieved from its pledge under the loan. Five quarterly dividends have now been passed.

Originally it was announced the loan would be at 4 per cent but documents from the R. F. C. have indicated 5 per cent with a possibility of lower rate.

Directors issued a supplementary statement, unaudited, reporting total sales \$7,657,552 for nine months of the current fiscal year ended June 30. Gross profit was \$31,551, other income \$25,640 and total administrative and other expense \$1,204,866 for net loss of \$1,147,675 for period.

Empire Securities, Inc., was reported to be holder of 18 shares of preferred and 1,068,944 shares of common, and also owner of all stock of the Willys Real Estate Realization Corp. Empire represents largely interests of Ward M. Canaday, George W. Ritter and C. O. Miniger. It was also revealed that Ajax Investment Co., personal holding company for Mr. Miniger, has 10,731 shares preferred and 46,709 shares common of Willys Overland.

President Frazer said the company will use \$1,500,000 of new money for tooling, inventories and working capital for the 1940 model and \$1,000,000 for 1941.

Oct. 9 Set as Tentative Date For Trial in Anti-Trust Case

Ourselves and Government—A Check List Of Federal Action Corrected to Aug. 8

Federal Trade Commission

VS-GENERAL MOTORS. Rebuttal testimony by respondent began in New York on Aug. 2. Case involves FTC allegation that GM dealers are required to handle GM parts to the exclusion of others.

SIX PER CENT CASE. Final arguments completed in both Ford and GM cases involving the FTC charge that the two companies allegedly engaged in false and misleading representations in finance plan advertising. The cases are now before the Commission for decision.

F.O.B. PRICE CASE. Testimony in GM case closed. Hearing in Ford case to be held late this month. This is expected to close the case. The FTC alleges that both companies engaged in misleading price advertising.

FAIR TRADE PRACTICE RULES. (No developments.)

ANTI-TRUST CASE. Special Judge Walter C. Lindley, Danville, Ill., who will hear the anti-trust case of the federal government against General Motors and its affiliated finance companies, has overruled the defendants' demurrer when he held that the indictments by the federal grand jury of the United States district court at South Bend, were valid. Judge Lindley also denied the plea of the defendants in which they demanded a bill of particulars be filed by the government. Judge Thomas W. Slick disqualified himself in the case several weeks ago. Before making his ruling, Judge Lindley vacated a previous decision by Judge Slick in which the latter overruled a demurrer by the defendants. It was agreed by the government and defendants to permit Judge Lindley to rule again on the demurrer since Judge Slick had disqualified himself as judge in the case after making his ruling in Hammond, Feb. 16. It is believed certain the anti-trust case will go to trial on the issues involved and a tentative date of Oct. 9 has been fixed by Judge Lindley. The trial will be held in the South Bend division of the northern Indiana United States court district.

National Labor Relations Board

Defense of the Goodyear Tire & Rubber Co., against the charge that its agents coerced employees in order to discourage union activity, was scheduled to start in Akron, Aug. 8, before Tilford E. Didley, special trial examiner for the National Labor Relations Board. Goodyear officials were

expected to take the witness stand at the start of the defense testimony.

In a long drawn out hearing during which dozens of witnesses took the stand, the United Rubber Workers Union of the C.I.O. presented testimony allegedly showing that the Goodyear riot of May 26, 1938, was incited by the company and that company officials intimidated employees and dominated the Goodyear Employees Association which was organized in opposition to the C.I.O.

The General Motors Corp.'s Delco-Remy plant at Anderson, Ind., has been ordered by the National Labor Relations Board to disband the Delco-Remy Employees' Assn., Inc., and to discontinue the alleged practice of "spying upon the union activities of its employees." The board said that between July, 1935, and January, 1937, the company had paid out an average of \$185 a month for espionage service by National Metal Trade Association.

The company also was directed by the NLRB to afford all its employees "protection from physical assaults or threats of physical violence directed at discouraging membership in, or activities on behalf of, International Union United Automobile Workers of America, or any other labor organization, and to instruct its employees at the plant—taking appropriate action to en-

force such instruction—that they may not make or carry blackjacks or other dangerous weapons in the plant without express authorization from the corporation."

At the same time the board dismissed charges that the company encouraged and assisted the Citizens League for Industrial Security of Anderson.

Stewart Plant Equipment Sold

The entire plant and equipment of Stewart Motor Corp. of Buffalo has been sold to Chinese interests, it has been reported. Amount involved in the deal was not disclosed.

Efforts to sell the Stewart plant and equipment have been under way here since the company voted to liquidate about six months ago. A representative of Chinese interests who made the purchase refused to bare details other than to confirm the sale. It was learned, however, that all of the plant's machinery and equipment will be moved to China where it reportedly will be used in the manufacture of trucks similar to those produced here by the company for many years.

Shipping of the equipment is scheduled to get under way immediately and it is estimated it will take a year before all of it is moved to the Orient. Fate of the plant buildings themselves could not be learned although they were reported involved in the sale.

A good portion of Stewart's foreign business formerly came from China and for this reason, it is believed, Chinese concerns became interested in the Buffalo plant and equipment following liquidation.

AUTOMOTIVE INDUSTRIES

Summary of Automotive Production Activity

BUSES Although some of the recent discussion of Federal financing of new railroad equipment centered around possible extension of bus services by the carriers, no reports of actual inquiries have been made. Little change in operating rates since last reported. Activity mostly in replacement units.

TRUCKS Manufacturers generally report production schedules better than anticipated. Dealer stocks reported low in many cases and build-ups behind on orders. No signs of any immediate slackening.

TRACTORS Production for most companies holding up well on newer "general purpose" models. Sales in many cases reported better than seasonal.

AUTOMOBILES Output during the first week in the month estimated at 24,000 units with the second week expected to be slightly lower. Considerable upswing anticipated for second half of August with a number of important producers expecting to get under way on final assemblies. AMA official estimate of July output set at 218,000 cars and trucks.

MARINE ENGINES No important changes since last report. Sales are exceeding last year's mark with every prospect of continuing well into the fall.

AIRCRAFT ENGINES Backlogs of orders for engines and parts continue to mount in spite of the heaviest production schedules in recent years.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.

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Auburn Plans for Reorganization

The Auburn Automobile Co.'s plan of reorganization under Section 77-B of the Federal Bankruptcy Act, was filed with the U. S. district clerk at Fort Wayne, July 28. The company has been operating under court order for several months pending reorganization.

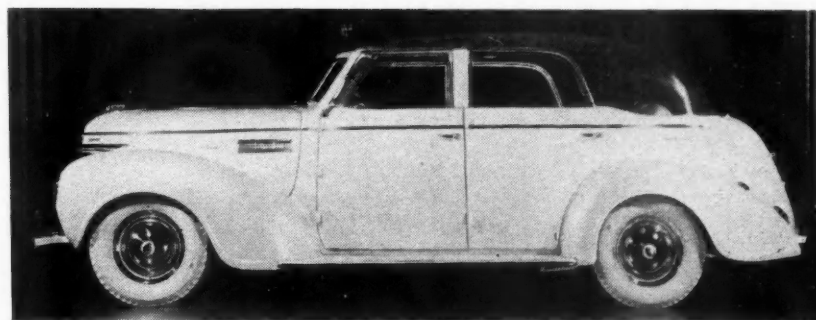
Refinancing proposal calls for issue of seven-year, five per cent convertible mortgage bonds, under and subject to the provisions of an indenture to be made by the company to the trustee, who is to be named by the court. Judge Thomas W. Slick will review the plan.

The plan also calls for elimination of present fixed charges on three-year 4% per cent convertible debentures now in default, and liquidation of all subsidiaries except Lycoming Manufacturing Co. Subsidiaries include an Auburn household appliance and equipment plant and Auburn Sales Corp.

To dispel a misunderstanding, said to be prevalent concerning the Columbia Axle Co., Mr. J. K. MacGowan, chairman of the board of Auburn Automobile Co., has stated, "The plan of reorganization has no effect upon the business or affairs of Columbia Axle Co., as that company is not a subsidiary of Auburn Automobile Corp. Both Auburn Automobile Corp. and Columbia Axle Co., however, are subsidiaries of Aviation & Transportation Co."

Japanese Claim New Alloy for Aircraft

A recent report to the Department of Commerce by the office of the American Commercial Attache in Tokyo indicates that two members of the Tokyo Imperial University's Aeromechanical Research Institute claim to have compounded a



Transparent Top

This Plymouth sedan, with top made entirely of transparent plastic developed by Briggs Manufacturing Co. for the Chrysler Corp., is now on display at Chrysler's World's Fair exhibit. Briggs has done considerable work in developing a new plastic to be used for automobile construction. The new material, called "Steelplast," is claimed to be stronger than steel, considerably more crash-proof, and very tough without being brittle. Its makers claim "Steelplast" has a tensile strength of 52,000 lb. per sq. in. as contrasted to 44,000 for body steel now in use. John Tjaarda, head of Briggs' design research department, states that eventually the material may also be used for bearings, cylinder blocks, transmission cases and many other parts. It has twice the expansion of steel but is said not to corrode or deteriorate.

new light alloy metal which is called "extra-superduralumin." The new metal which is compounded of aluminum, copper, zinc, manganese, magnesium and other metals, is declared to be immune to all climatic conditions to which air disasters are often described. Japanese authorities claim that the new metal, which is also known as "S.S.B.," is superior to all other light metals used for aeromechanical purposes. Compared with R. R. 77, compounded by British physicists last year, which has a tensile strength of 45 kilos, S.S.B. is said to have a tensile strength of 53 kilos. Large scale production is scheduled, according to a press report.

United Specialties Financial Report

Report of United Specialties Co. for the quarter ended June 30, 1939, showed a net profit of \$20,347.63, equal to 14 cents a share on 143,000 shares of common stock. This compares with a net loss of \$37,161.67 in the June quarter of the previous year and a profit of \$31,534.35 for the quarter ended March 31, 1939.

For the six months ended June 30, the net profit of \$51,881.98 compared with a net loss of \$56,704.69 in the first half of 1938.

New Passenger Car Registrations

	JUNE 1939	MAY 1939	JUNE 1938	SIX MONTHS		Per Cent Change, 6 Months, 1939 over 1938	Per Cent of Total Six Months		EIGHT MONTHS MODEL YEAR		
				1939	1938		1939	1938	1939	1938	Per Cent Change
Chevrolet	57,674	65,003	36,914	331,895	239,706	+ 38.5	23.55	24.61	435,679	345,121	+ 26.4
Ford	45,009	49,352	31,106	252,782	204,830	+ 23.4	17.94	21.03	319,368	252,200	+ 26.6
Plymouth	31,640	39,680	25,368	198,627	136,799	+ 45.2	14.10	14.04	265,919	186,478	+ 43.0
Dodge	18,154	22,631	8,748	108,719	54,792	+ 98.4	7.72	5.63	136,788	80,403	+ 71.3
Buick	18,375	20,591	13,168	108,555	80,356	+ 35.1	7.70	8.25	146,386	114,164	+ 28.1
Pontiac	14,499	16,557	8,237	82,279	50,716	+ 62.3	5.64	5.21	108,019	73,603	+ 46.2
Oldsmobile	12,485	14,339	7,702	74,149	47,802	+ 55.2	5.26	4.91	99,552	67,951	+ 46.5
Chrysler	5,978	7,457	4,098	37,632	25,317	+ 48.6	2.67	2.60	46,429	37,680	+ 28.4
Strdebaker	8,263	8,780	2,762	35,322	17,326	+104.0	2.51	1.78	44,790	25,027	+ 79.0
Mercury	6,139	6,776	3,308	32,308	17,473	+ 64.7	2.29	1.79	39,143	24,819	+ 38.7
Nash	4,704	5,504	2,728	28,834	18,975	+ 50.0	2.05	1.95	34,438	28,158	+ 29.5
De Soto	5,204	5,488	3,090	28,458	18,975	+ 23.7	2.02	2.17	36,543	30,406	+ 16.8
Hudson	4,783	5,239	3,341	26,122	21,137	+ 23.7	1.85	2.63	35,529	36,382	- 7.7
Packard	4,504	6,059	4,111	24,435	25,573	- 4.7	1.73	2.63	33,502	10,710	+ 49.5
La Salle	1,852	2,208	1,111	11,455	7,271	+ 57.5	.81	.75	16,059	12,919	+ 6.2
Lincoln	1,557	1,899	1,541	10,369	9,479	+ 9.5	.74	.97	13,731	6,942	+ 38.2
Cadillac	1,077	1,285	836	6,941	5,685	+ 22.0	.49	.58	9,597	11,405	- 30.2
Willis-Overland	1,047	1,099	1,020	6,023	6,952	- 13.4	.43	.71	7,945	3,829	+ 17.5
Graham	429	540	307	2,441	2,469	- 1.1	.17	.25	3,155	897	+ 10.6
Hupmobile	115	184	93	670	591	+ 13.3	.05	.06	771	582	+ 32.6
Bantam	113	129	582	582	582	0.0	.04	.04	582	582	0.0
Crosley	90	90	90	90	90	0.0	.01	.01	90	90	0.0
Fiat	6	6	6	6	6	0.0	.00	.00	6	6	0.0
Miscellaneous	44	28	103	356	774	- 54.2	.03	.08	752	1,220	- 38.4
Total	243,741	280,834	156,384	1,409,102	974,023	+ 44.7	100.00	100.00	1,836,935	1,350,114	+ 36.0
Chrysler Corp.	60,976	75,256	41,304	373,436	235,883	+ 58.0	26.50	24.22	487,679	332,719	+ 46.5
Ford Motors Co.	52,705	58,027	32,647	295,459	214,309	+ 37.8	20.97	22.00	372,242	285,119	+ 40.3
General Motors	105,983	119,983	67,968	615,274	431,536	+ 42.4	43.66	44.30	815,492	618,491	+ 31.8
All Others	24,098	27,568	14,465	124,933	92,295	+ 35.9	8.87	9.48	161,522	133,785	+ 20.7

World Registrations

(Continued from page 175)

products is universally favorable. Low prices resulting from mass-production methods, combined with modern styling, rugged dependability, and comparatively inconsequential maintenance charges are contributing factors in extending the sales of our motor vehicles, parts, accessories and servicing equipment throughout the world.

On January 1 of this year, American motor vehicles represented 80.3 per cent of the total world registrations, and 38.2 per cent of all the units in operation outside of the United States.

Following the United States, which has 68 per cent of the total world motor vehicle registration, the relative positions of the other chief users of motor transportation remain unchanged from a year ago, the report stated. The United Kingdom is the second most important nation of motorization with 2,610,559 units; France has 2,251,300 vehicles; Germany accounts for 1,816,200; Canada has 1,375,133; Australia has 757,982; U.S.S.R. represents 672,953; Italy reports 467,624 and the Union of South Africa 350,281.

PUBLICATIONS

The Motor Tool Mfg. Co., Detroit, has issued two pamphlets. One describes the company's "economical live ball and roller bearing center" for lathes, mills, hand screw machines and grinders. The other covers a new "roll-grip keyless chuck."

"Q-C" Standardized Production Tooling Method" is the title of a booklet prepared by Q-C Engineering Products, Detroit.*

Three pamphlets recently brought out by the **Bulldog Electric Products Co.**, Detroit, are: "How to Mobilize Lighting and Power Outlets in Industrial Plants with Trol-E-Duct"; "The New Bulldog Vacu-Break Safety Switch"; and "Industrial Type Bulldog Trol-E-Duct."*

The Oilgear Co., Milwaukee, Wis., has issued bulletin 20,000 which illustrates and describes the company's new line of type "XL" horizontal broaching machines.*

A new type of gage for checking inside diameter, out-of-roundness and trueness of bores, such as automobile cylinders, and cylindrical work requiring great accuracy is described in a leaflet issued by the Federal Products Corp., Providence, R. I.*

A bulletin by Joseph T. Ryerson & Son, Inc., describes its **Stressproof Steel—No. 2**, a non-warping shafting and machinery steel combining high strength, free machineability.*

A catalog by American Automatic Devices Co. lists and describes its King Bee line of approved safety equipment for trucks, buses and trailers and automobile accessories.*

"Thermocouples and Accessories," a 36-page illustrated bulletin has been announced by the Foxboro Co.*

A booklet, "Lead-Bronze Bearings", has been released by the Copper Development Association, London. It is a translation



Leslie S. Gillette

... recently appointed executive vice-president of the Hazard Advertising Corp. Mr. Gillette joins the Hazard staff after being advertising and sales promotion manager of U. S. Industrial Alcohol Co. since 1930. He was for four years Detroit technical editor of the Chilton automotive publications.

from the German book published by Deutches Kupfer-Institut.*

A folder on "Rockflux", its acid resistant floor resurfacer, has been published by Flexrock Co.*

Two new forms have been released by Caterpillar Tractor Co. One describes its 800G engine, a single-cylinder, air-cooled 5.5 hp. unit especially well suited for pumping jobs. The other contains specifications of the new Caterpillar single drum, rear mounted tractor cable control.*

A booklet, published by the National Highway Users Conference, contains results of studies made by H. E. Stocker, assistant professor of Transportation, New York University, on the question—**Is Motor Transportation Subsidized?***

A booklet of cartoons and charts by the American Petroleum Industries Committee gives a picture of the motor vehicle tax situation.*

Bulletin 307 of the Reliance Electric & Engineering Co. describes and illustrates its type V*S drive, an all-electric adjustable-speed drive for alternating current circuits.*

"Dollars Behind Steel", a booklet by the American Iron and Steel Institute, is the story of money's part in the steel industry.*

A truck driver's guide, containing a number of suggestions on how to keep operating costs down and to drive with maximum safety, has been prepared by Dodge Truck Division of Chrysler Corp., Detroit.*

A 24-page catalog, showing the complete line of Imperial oxy-acetylene and oxy-hydrogen welding, cutting, brazing and lead-burning equipment, soldering equipment, gas and air torches and welding supplies, has just been issued by the Imperial Brass Manufacturing Co.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

CALENDAR

Conventions and Meetings

National Petroleum Association, Annual Meeting, Atlantic City, Sept. 13-15
SAE Tractor Meeting, Hotel Schroeder, Milwaukee, Wis. Sept. 28-29
American Society of Tool Engineers Meeting, Cleveland Oct. 5-6
SAE National Aircraft Production Meeting, Hotel Biltmore, Los Angeles, Calif. Oct. 5-7
SAE Annual Dinner, Hotel Pennsylvania, New York, N. Y. Oct. 16
American Welding Society, Annual Meeting, Chicago Oct. 22-27
American Trucking Association, Annual Meeting, Chicago Oct. 23-24
SAE Transportation & Maintenance Meeting, Coronado Hotel, St. Louis, Mo. Oct. 26-27
SAE Fuels & Lubricants Meeting, Mayo Hotel, Tulsa, Okla. Nov. 2-3
American Petroleum Institute, Annual Meeting, Chicago Nov. 13-17
National Independent Traffic League, Annual Meeting, Chicago Nov. 23-24
Motor & Equipment Wholesalers Association, Annual Convention, Chicago Dec. 8-9
SAE Annual Meeting & Engineering Display, Book-Cadillac Hotel, Detroit Jan. 15-19, 1940

Shows at Home and Abroad

Automobile Accessories Association, Sixth Annual Exposition, Navy Pier, Chicago Aug. 7-10
National Machine Tool Show, Cleveland Oct. 4-13
Great Britain, London, Automobile Show Oct. 12-21
Rochester, N. Y., Automobile Show, Oct. 14-21
Indianapolis, Ind., Automobile Show, Oct. 15-21
Los Angeles, Cal., Automobile Show, Oct. 15-22
National Automobile Show, New York, Oct. 15-22
Newark, N. J., Automobile Show, Oct. 21-28
Baltimore, Md., Automobile Show, Oct. 21-28
Buffalo, N. Y., Automobile Show, Oct. 21-28
Detroit, Mich., Automobile Show, Oct. 21-28
Milwaukee, Wis., Automobile Show, Oct. 21-28
Pittsburgh, Pa., Automobile Show, Oct. 21-28
Toronto, Ont., Automobile Show, Oct. 21-28
St. Louis, Mo., Automobile Show, Oct. 22-28
National Metals Congress and Exposition, Chicago Oct. 23-27
Italy, Milan, Automobile Salon, Oct. 25 to Nov. 11
Philadelphia, Pa., Automobile Show, Oct. 26-Nov. 1
International Automobile, Motorcycle and Motor Boat Show, Budapest, Oct. 27 to Nov. 6
Great Britain, London, Commercial Automobile Transportation Show, Nov. 2-11
San Francisco, Cal., Automobile Show, Nov. 3-9
Chicago, Ill., Automobile Show, Nov. 4-12
National Truck Show, Chicago, Nov. 8-16
Great Britain, Glasgow, Scotch Automobile Show, Nov. 10-18
Butte, Mont., Automobile Show, Dec. 4-5
Automotive Service Industries Show, Navy Pier, Chicago Dec. 11-16

MEN and MACHINES

(Continued from page 174)

0.70, a short time rating may be used. If a short time rating is applicable and the ratio of time-on to time-off is less than 1:4 and also if the motor cannot be operated uninterruptedly more than 15 minutes out of each 75, a $\frac{1}{4}$ hour rating can be used. If, under the same conditions, the ratio of time-on to time-off is less than 1:2 and more than 1:4, and if the motor cannot be operated uninterruptedly more than 30 minutes out of each 90, a $\frac{1}{2}$ -hour rating can be used. If the ratio of time-on to time-off is greater than 1:2 or if the motor can be operated more than 30 minutes uninterruptedly, a 1-hour rating is recommended.

The time rating determination applies to alternating current motors and to constant speed direct current motors. Since adjustable speed direct current motors are not standard in ratings less than 1 hour, the $\frac{1}{2}$ and $\frac{1}{4}$ hour ratings cannot be used for these. The advantages of smaller size and lower cost which goes with $\frac{1}{2}$ and $\frac{1}{4}$ hour motors, usually is worth while only in direct current motors, altering current high starting torque and high slip motors and alternating current totally enclosed, non-ventilated motors."

It is regrettable that we don't have more space to give to a more detailed reporting of Mr. Ridgway's paper. Those readers of *Men and Machines* who would like to peruse the complete paper may be able to obtain a copy from the Westinghouse Editorial Service department of Westinghouse Electric & Mfg. Co. in East Pittsburgh, Pa.

The Fellows Gear Shaper Co., Springfield, Vt., recently placed on the market a new machine for finishing external spur and helical gears by a process employing a rotary finishing tool. The machine is provided with head and tailstock slides, and head and tailstock spindles, the latter carrying "live" centers upon which the work is mounted. Where the work is of the integral shank type, it is held directly on the centers. Where it is provided with a hole, it is retained on an arbor, and the latter placed on the centers of the machine. The tool, which is of the rotary type, is held in an adjustable head that can be set to any desired angle for finishing both spur and helical gears. This head is mounted on a slide which is rapidly reciprocated. Employment of rapid reciprocation of the tool greatly enhances the cutting action, and permits the removal of considerable material and the production of a fine finish on the work. The combination of rapid reciprocation and high speed rotation also results in the production of extremely accurate gears as to tooth shapes, spacing, etc.

Another interesting feature of the machine is its ability to employ two distinct methods of operation. The axis of the tool can be set at an angle with relation to the axis of the work, and the gear finished by what is known as the

"crossed-axis" method; or the axis of the tool and the work can be set parallel to each other and the gear finished by what is known as the "parallel-axes" method. This latter method is particularly advantageous in the finishing of shoulder or cluster gears where it is necessary for the tool to operate into a recess or close to a shoulder. An accompanying illustration shows a cluster helical gear being finished by the "parallel-axes" method in which case a helical tooth tool is used.

This machine has a capacity for spur and helical gears up to 18 in. pitch diameter, 5 in. face width. The cutting time, of course, is controlled by change

gears, and the range is from 25 sec minimum to 10 min. maximum.

Potter & Johnston Machine Co., Pawtucket, R. I., has supplied us with some interesting facts on a recent application for one of its 4-D automatic chucking and turning machines. The job in question calls for three operations on a radial aircraft engine reduction gear pinion made from a drop forging of high Brinell reading (260). There is considerable stock to remove, a deep trepanning cut is required, which is undercut at the bottom, and the final finish must be to an exceptionally high standard. The close-up photograph reproduced herewith will give a fair idea



REDUCE CYLINDER WEAR •
REDUCE OIL FEED •
PROTECT AGAINST SEIZURE •
IMPROVE VALVE OPERATION •

with **dag**
REG. U.S. PAT. OFF.
COLLOIDAL GRAPHITE

In all equipment lubricated with oil containing "dag" colloidal graphite, the advantages resulting come from the formation of smooth, self-lubricating graphoid surfaces on the friction parts.

Air compressors are no exception. Better piston seal and less wear can be expected. "Dag" being unexcelled as a high temperature lubricant, the value of this surface when high compression is undertaken is evident.

Furthermore, the "dag" formed graphoid surface enables the oil-feed to be cut materially. Reduction in the amount of oil vapor present and in the formation of carbon naturally follows.

A request on your letterhead will bring an inspection sample and Bulletin No. 112 describing the running-in of mechanical devices with "dag" colloidal graphite.

Your oil supplier can easily add "dag" to your present lube or to specially selected petroleum fluids.

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN



of the type of special tooling used for the recessing cut. The slide tool shown on the fifth turret face is located at the extreme right-hand side of the illustration. When that particular turret face is presented to the work, the tool and the entire turret slide are supported by an overhead pilot bar. As the turret slide advances to the dwell of the operating cam, the cutting tool in the boring bar having reached its full depth, is then fed over by the action of the cross slide against the slide tool on which the boring bar is mounted.

Studies of actual production have produced the following estimates of machining time (average amount of

stock to remove is 3/16 in. on a side):

Machining time		Floor to	Production
		floor time	per 51-min.
1st Oper.	3.44 min.	3.69 min.	13.8 pieces
2nd "	12.61 "	12.86 "	4 "
3rd "	4.92 "	5.17 "	10 "

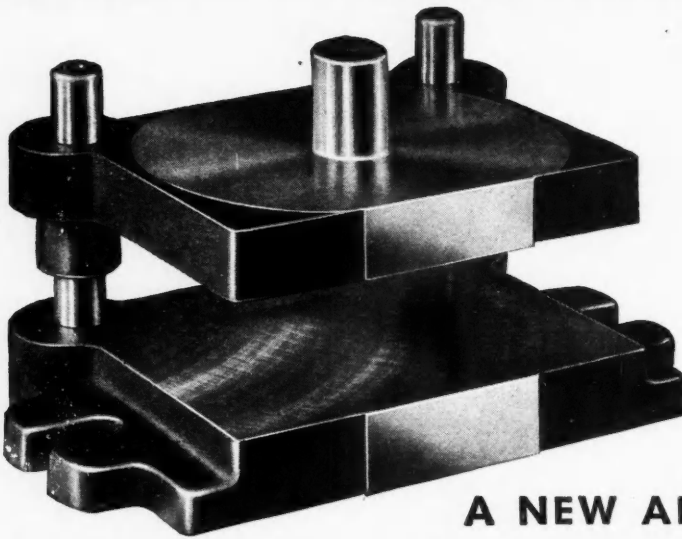
Two new die heads designated as models 16S and 16SB have been announced by the Jones & Lamson Machine Co., Springfield, Vt. The model 16S is designed for use on small hand screw machines, and is provided with an adjustable pull-off and a hand locking lever. The model 16SB has an external trip and is recommended for use on No. 0 and No. 00 Brown & Sharpe automatics. This die is designed so

that it cannot open during the indexing movement on high speed machines.

On these two models, both the top and bottom of the chasers are provided with chamfer and top rake. After they become dull on the top, they may be turned over, making them equivalent to two sets of ordinary radial type chasers. The chasers are ground in the thread form after hardening. Each chaser is secured to the chaser-holder by a single screw which forces it against two ground surfaces. The chasers may be sharpened.

Here are some additional new developments for which space limitation unfortunately will not permit more than brief mention: An all-steel work container, combining in a single unit three types of work handling equipment—a bin, a rack, and a pallet—has been developed by Mechanical Handling Systems, Inc., Detroit. It is called the "Collapsi-Bin." . . . Acheson Colloids Corp., Port Huron, Mich., reports that for tapping operations, particularly in castings and forgings of aluminum and similar alloys, an excellent cutting compound has been found to consist of "dag" colloidal graphite suspended in mineral oils. . . . A combination tool for grinding, light drilling, polishing, sanding and filing operations has been added to the line of flexible shaft units manufactured by the Stow Mfg. Co., Binghamton, N. Y. . . . Hobart Brothers Co., Troy, Ohio, have announced a new AC arc welder with a range of 20 to 200 amp. and for use on 220 single phase power lines. . . . Two new AC arc welders have been announced by the Marquette Mfg. Co., Minneapolis, Minn. The 400 BT has a range from 30 to 350 amp. A model 300 BT is similar to the company's model 300 B but is mounted on a new type truck. The latter model has a range of 20 to 250 amp. . . . Brown & Sharpe Mfg. Co., Providence, R. I., has developed a silent stock support for its wire feed screw machines. The new support is said to eliminate objectionable noise created by the rotation of stock in the regular stock tube. . . . A complete line of high speed air operated drop stamps incorporating new improvements resulting from an exhaustive study of the severe impact stresses encountered under production conditions has been announced by the Lake Erie Engineering Corp., Buffalo, N. Y. . . . Something new in hacksaw blades is the Silver Steel line recently announced by E. C. Atkins & Co., Indianapolis, Ind. Consideration has been given in design of the blades to such requirements as the strength of teeth necessary to withstand the rigorous standards of speed and feed as applied to modern high production hacksaw machines. . . . A standard line of heavy duty speed reducers incorporating the cone area-contact type of worm gear has been announced by Michigan Tool Co., Detroit. . . . A new roller-type portable conveyor made of 61 S.T. Alcoa aluminum has been placed on the market by the Aluminum Ladder Co., Tarentum, Pa.—H. E. B., Jr.

DANLY *Announces*



A NEW AND ENLARGED LINE OF PRECISION DIE SETS

[Danly Precision Guide Posts are ground, and lapped to plus or minus .0001" of listed dia. Precision Bushings are ground and honed to plus or minus .0001" of listed dia.]

To meet the rapidly growing needs of the stamping industry, Danly Precision Die Sets are now available in a complete range of sizes of standard, back post sets for any die from 3" x 3" to 16" x 25".

Especially useful are a new square series, in sizes from 3" x 3" to 14" x 14".

The regular standard line has also been expanded, many new sizes added, and the line extended in the larger sizes.

If you have not received a copy of the new Danly Catalog, 10th Edition, which we believe is the most useful, easily used catalog in the industry, write for your copy.

Here you will find everything you need in standard die sets for the complete range of die requirements—and remember each size is stocked in each of the 8 Danly Branches for immediate delivery.

DIE BUYERS—
Specify Danly
Die Sets
for Your Dies

DANLY MACHINE SPECIALTIES, Inc.
2130 So. 52nd Ave., Chicago, Ill.

It will be good business for you both

DIE MAKERS—
Include Danly
Die Sets in
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DANLY DIE SETS and DIE MAKERS' SUPPLIES

Their Dependable Quality Means Lower Cost Stampings

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OUR COSTS

IT CARRIES
HEAVIER
LOADS

IT TAKES
LESS SPACE

IT'S
EASIER TO
ASSEMBLE

IT'S
FAR MORE
DEPENDABLE



BANTAM'S new-type Standard Series Quill Bearings have scored a phenomenal sales success based solely on operating success. In a wide range of industries they have proved their ability to solve bearing problems of long standing. Repeat orders prove the satisfaction of users who write us enthusiastically about savings in cost and improvements in performance.

This new type Quill Bearing is built to the same high quality standards as the Bantam Quill Bearings used on Diesel-powered streamline trains. The design is greatly simplified. There are no fragile parts—no possibility of failure. New method of roller retainment provides for quick, easy assembly. End thrust is taken on the ribs of the one-piece channel-shaped outer race. Correctly proportioned rollers with husky curvilinear trunnions insure longer service.

For complete engineering data, write us for Bulletin 103C. For Needle Bearings to be used in lighter service write our affiliate, The Torrington Company, Torrington, Conn., and ask for Circular 21A.

BANTAM BEARINGS CORPORATION

South Bend, Indiana

Subsidiary of THE TORRINGTON CO.
Torrington, Conn.

WIDE RANGE OF SIZES CARRIED IN STOCK



TAPERED ROLLER—STRAIGHT ROLLER—BALL

BANTAM

BEARINGS

New Developments in Automotive Materials

(Continued from page 155)

of a number of oils by different additions of Elektrion R oil.

It is further claimed for Elektrion R oil that it lowers the A.S.T.M. pour point of practically any oil to which it may be added, and that it increases the "oiliness." In explanation of this latter effect it is stated that the oil molecules undergo a change during the electronic treatment, which considerably increases the bulk of the oil, and that particles of the oil after treatment have a high physico-chemical activity, as in-

dicated by the fact that they clog water particles. Owing to the higher "oiliness," wear will be reduced on parts of the bearing surface on which the lubricant film may be reduced to molecular thickness for any reason.

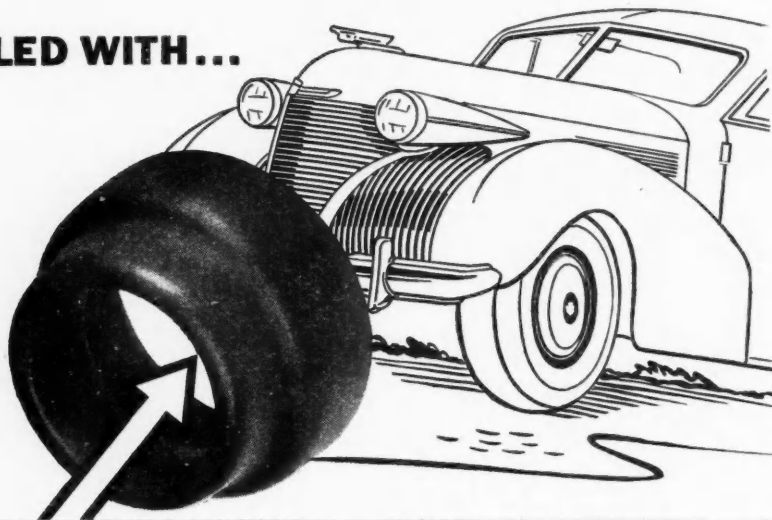
Elektrion R oil is said to dissolve the oxidation products of any oil to which it may be added, for which reason it is a powerful anti-sludging agent. It is a solvent also for low-temperature oxidation products of motor fuels. Most of the carbonaceous material formed

by the cracking of the lubricating oil and incomplete combustion of the fuel is reduced to a quasi-colloidal condition by Elektrion R oil, in which condition it cannot clog the engine, cannot separate out of the oil even under centrifu-

CADILLAC

knee-action suspension rod

SEALED WITH...



DU PONT NEOPRENE

IN planning 1938 and future models, Cadillac engineers set about designing a new knee-action assembly which would give easier steering permanently. To insure this they planned a system whereby joints could be permanently lubricated.

A solid metal seal was out of the question because of the action. Instead they needed one which would be resilient and oil-resistant. What, then, should they use? That was the problem confronting these Cadillac engineers.

After exhaustive tests of seals of various materials, they finally discovered that only *one* material would meet their exacting requirements. Only *one* material had the strength, resilience and oil-resistance to make the perfect seal. Only *one* material gave proof that it would endure the long, gruelling life necessary for customer satisfaction. And that one

material was *neoprene*.

So these engineers specified *neoprene* . . . to seal both ends of the lower suspension rod of this new assembly.

The problem was solved.

Neoprene has the strength, resiliency and toughness of rubber . . . but it is far more resistant to petroleum distillates and to aging. For current information about this remarkable material, write for your free subscription to the new monthly Neoprene Notebook. Du Pont, Rubber Chemicals Div., Wilmington, Delaware.

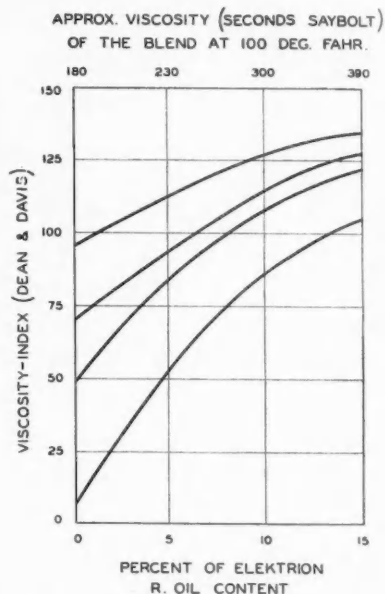
Make that part better with



NEOPRENE

CHLOROPRENE RUBBER MADE BY DU PONT

Consult your rubber supplier, or write us



Effect of Elektrion R oil additions on the viscosity index of various mineral oils having a viscosity of 180 seconds Saybolt at 100 deg. Fahr.

gal influences, and is harmless in the suspended state in the oil, not decreasing its lubricating value.

We are informed that Elektrion-blend lubricating oils have been marketed in Europe under various trade names for years and have been sold at the rate of millions of gallons per year.

Handy Moves to Ann Arbor, Mich.

All departments, including general offices, of the Handy Governor Division of the King-Seeley Corp. have been moved from Detroit to the main headquarters of the corporation in Ann Arbor, Mich., where a large additional plant was recently completed for the Governor Division's use.

Arthur A. Bull, Handy president prior to the merger, becomes vice-president of the corporation and continues in charge of the Governor Division.

New Ford Plant For South Africa

Consistent increase in the volume of sales of Ford-built cars and trucks in South Africa has resulted in a decision to construct a \$250,000 addition to the plant of Ford Motor Co. of South Africa, Ltd., at Port Elizabeth. The South African company is operated as one of the five overseas subsidiary companies of Ford Motor Co. of Canada Ltd., Windsor, Ont.